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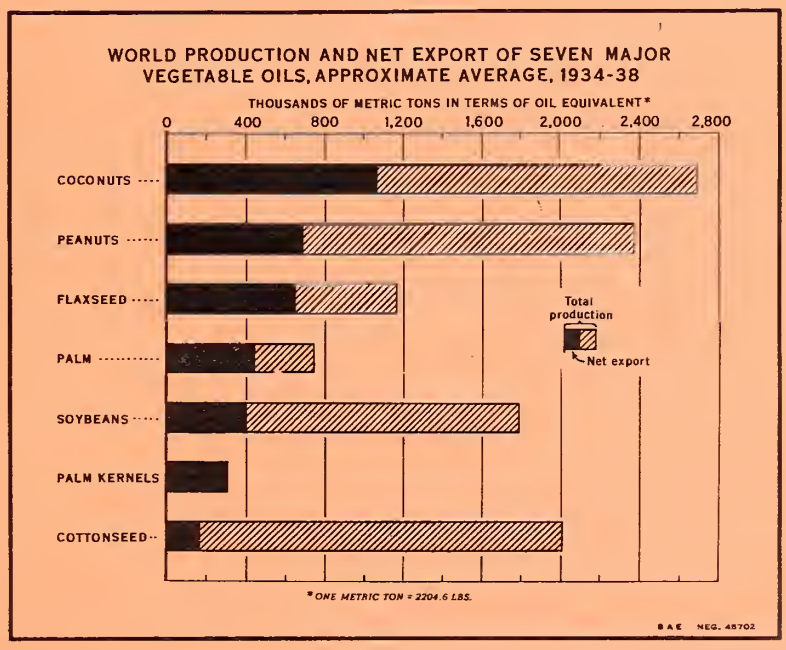
WORLD TRENDS *in* Major Oil Crops



by Peter L. Hansen

WASHINGTON, D. C. MARCH 1946

Source of Data

The data used in this report were obtained principally from statistics originally published by the International Institute of Agriculture, at Rome, Italy. This source was chosen because of its broad coverage of the statistics of oil crops and because it included estimates of production in certain cases where other official data were not available. It is recognized that the data occasionally differ from those available elsewhere particularly with respect to individual countries. In no instance have these differences appeared to be of sufficient importance to affect major trends. Looking ahead, the estimates for 1955 are based on certain general assumptions explained in the text and they rely partly on general trends prevailing during the interwar period and partly upon information about competitive factors and current and prospective changes.

Acknowledgments

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WORLD TRENDS IN MAJOR OIL CROPS

By Peter L. Hansen, Agricultural Economist

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INTRODUCTION

The future economic position of the war-expanded vegetable-oil crops is a subject of growing interest as the United States faces its agricultural conversion problems. Any adequate appraisal of the long-time outlook must take full account of what is happening in competing countries. The purpose of this report is to look at the broad international trends and to attempt to interpret their meaning.

Oils and fats include a large number of different products of both plant and animal origin. Each of these products has its own characteristics and the market prospects of each have always been related to the demand for these special characteristics as well as to the demand for oils and fats in general. Although special qualities will continue to play an important part they may be less influential in the future than in the past. Increasingly, technology has been widening the areas of possible substitution between different oils and fats and increasing their interchangeability. This means that for most of the major oils relatively more attention may need to be given to the over-all trends in production and consumption. Flaxseed producers in the United States, for example, need to be as interested in soybeans of the Corn Belt and coconuts from the Pacific Islands as in flaxseed from the Argentine.

PROCEDURE AND ASSUMPTIONS

The general procedure used in this analysis has been to study first the past trends for each of the major oil crops. These trends are then analyzed for each of the leading producing countries. The conditions of production are examined and the reasons for past changes are sought. Special attention is directed to wartime developments and probable after effects. New and prospective factors are considered. Finally a projected estimate is made of future production about the year 1955; this is not intended as a forecast but as a conditional estimate. It is based on several broad assumptions. The most important of these are: (1) General prosperity and peaceful economic progress throughout the world for the next decade and (2) international trade on a somewhat less restricted basis than before the war.

The projected estimates for production and export of each oil were made by the writer after consultation with various commodity specialists in the Department of Agriculture. They were made, country by country, in the light of the best available information and in view of probable adjustments that might take place in other crops and in livestock production in each country under the general assumptions stated. In several instances the basic data are not fully adequate and there is much uncertainty about the probable extent of change. The resulting estimates are to be regarded as first approximations which are probably more dependable for the broad over-all totals than for details.

NATURE OF WORLD COMPETITION IN OILS AND FATS

The world competition in oils and fats is a very complex set of phenomena on the supply side because of the varied conditions under which different oils and fats are produced. Some are main products which respond to changing price situations and others are byproducts which simply

follow the fortunes of the main product without much reference to the oils and fats situation. Cottonseed, for example, generally has but a small fraction of the value of the cotton fiber which goes with it. The world's output of cottonseed oil is therefore very little influenced by the price of oil, but is very much affected by the outlook for cotton fiber.

Some of the oil crops are planted annually and others come from trees which take a number of years to come into bearing. The output of oils from annual crops may be quickly adjusted, although the adjustment may not be made if the oil is a byproduct. The tree oils on the other hand are more nearly main products and they respond to changes in oil prices, but only after the lapse of some time.

The total world production of oils and fats just before World War II averaged nearly 20 million metric tons annually in terms of oil equivalent. The vegetable oils made up about two-thirds and animal fats and marine oils the remaining one-third of the total. These quantities do not include the so-called invisible consumption of fats in foods nor the direct native consumption of coconuts and other tropical nuts.

Most of the international trade in oils and fats consists of vegetable oils and marine oils. The animal fats are mainly consumed in the countries of production. Close to one-third of the world's vegetable-oil output, or about 4 million metric tons, entered world trade in 1934-38 and over one-half of the marine-oil production of about 750 thousand metric tons.

The outstanding change in the world oil and fat supply situation in the 25 years before the war was the vast expansion in the production of tropical and marine oils. This expansion was based on improved production methods - the colonial plantation system, the factory whaling ship, and the new practices associated with each - and the commercial development of hydrogenation and other improved processing methods. The new processing methods made it possible to use these oils on a large scale for margarine, shortening, and other purposes.

The continuing march of technology will apparently lead to further developments which will increase the interchangeability of the oils and add to the competition between oils and between producing areas.

Relative Importance of Oil Meal and Oil from Different Oil Crops

One of the important byproducts from most of the oil crops is the oil meal which is valuable as a feed because of its high protein content. For the majority of the oil crops the quantity of oil meal in 100 pounds

of oilseed considerably exceeds that of oil but is not worth as much because of the much lower value per pound. The highest ratio of meal to oil is obtained from soybeans in which the meal obtained from 100 pounds of beans normally is about equal to the value of the oil. High in oil content and low in oil meal are copra and babassu kernels both of which have a higher oil content and value than palm kernels. It should be remembered, however, that approximately 484 pounds of palm oil is obtained with each 100 pounds of palm kernels yielding 45 pounds of palm kernel oil (British Malaya). The relative value of oil and meal in palm kernels is especially important from the standpoint of transportation as the relatively low oil content may well make shipment uneconomical from inaccessible points in Africa.

Table 1 indicates how large the proportion of oil meal is for each pound of oil as well as the value of the oil meal obtained with each dollar of oil, under assumed values. Actual values for both oils and oil meals will vary from one another as well as from the assumed relationships.

Table 1.- Average yields of oil and oil meal per hundred pounds of oil-bearing material and ratio of oil meal to oil, United States

Oil-bearing material	Yield per hundred pounds: Oil	Yield per hundred pounds: Oil meal	Oil meal per pound of oil	Value of oil meal per dollar of oil 1/
	Pounds	Pounds	Pounds	Dollars
Cottonseed 2/	15.5	45.0	2.90	.58
Flaxseed 2/	34.0	64.0	1.88	.38
Peanuts 2/	29.0	43.6	1.50	.30
Soybeans 2/	15.0	80.0	5.33	1.07
Sesame seed	47.0	3/ 48.0	1.02	.20
Copra	63.0	3/ 35.0	.56	.11
Palm kernels	45.0	3/ 53.0	1.18	.24
Babassu kernels	63.0	3/ 35.0	.56	.11
Sunflower seed	25.0	3/ 73.0	2.92	.58

1/ Based on an assumed price of oil per pound five times that of oil meal.
2/ War Food Administration. Conversion Factors and Weights and Measures for Agricultural Commodities and their Products p. 31.
3/ Approximate average yield, as estimated by Office of Foreign Agricultural Relations, USDA.

The greatest quantity of oil meal, as compared with oil, is obtained from soybeans but cottonseed and sunflower seed are also high in this respect. An interesting aspect of the oil-cake or oil-meal byproducts is that these make for greater intensity in the production of milk, butter, and other animal products containing animal fats. These

in turn are directly competitive with the vegetable oils especially in their manufactured uses in margarine and shortening. Moreover, the rich manure resulting from the use of these oil meals adds to the fertility of the soil and brings heavier crops than would be possible otherwise, which again may contribute to increased production of animal fat.

WHAT ARE THE MAJOR OIL CROPS?

The major oil crops which are considered in this study made more than 90 percent of all of the vegetable oils produced in the 5 years 1934-38. They are shown in the following tabulation and the more important ones are shown in the figure on the cover page, in order of volume of net world exports. In terms of oil equivalent the average annual data for 1934-38 were as follows:

Oil Crop	Net Export 1,000 metric tons	Production 1,000 metric tons
Coconuts	1,060	1/ 2,675
Peanuts	681	2,370
Flaxseed	644	1,166
Palm	445	1/ 745
Soybeans	404	1,791
Palm kernels	310	2/ 310
Cottonseed	163	2,009
Olive	121	869
Tung	78	2/ 78
Sesame	68	693
Rapeseed and mustard seed	41	1,345
Sunflower	29	589
Babassu	12	2/ 12

1/ Estimated.
2/ Exports only.

Coconuts, peanuts, and cottonseed have the largest volume of world production. Cottonseed is relatively low in volume of exports because of the large domestic consumption in the United States and other producing countries. Rapeseed and mustard seed are another example of a large world production with but very little trade.

The first seven oil crops in the list - coconuts, palm, palm kernels, peanuts, flaxseed, soybeans, and cottonseed - make up more than nine-tenths of the exports listed. Three of the seven are definitely tropical; two more - cottonseed and peanuts - are warm-climate crops and only soybeans and flaxseed are crops of the cool temperate zone.

The trend in net export for the major oil crops and the leading exporting countries is shown in tables 2 and 3. In these tables the data represent net export of individual oil crops from individual countries which have been combined for all crops or countries to obtain the total net export entering world trade, although each country included may be a net importer if all vegetable oils are grouped together. Thus, table 3 shows a net export for Europe, although this continent is a heavy deficit area and imports huge quantities of vegetable oil seeds and oils. The net exports consist mainly of olive oils exported from Mediterranean countries to other countries in Europe as well as to countries in the western hemisphere. Small surpluses of other vegetable oils are also traded between countries in Europe but these exports make up a part of world trade and represent a net export for the individual oils considered.

LEADING OIL-CROP AREAS

Two broad regions have furnished most of the international competition in vegetable oils in the prewar decades. These are Southeast Asia and Central and West Africa. The first includes principally the Philippines, the Netherlands East Indies, and Malaya. The second is made up of the French, British, and Belgian colonies in Central and West Africa. These two broad regions supplied more than 80 percent of the increase in the world's net export of vegetable oils between 1924-28 and 1934-38.

Looking at the world from the continental point of view, Europe and North America are deficit vegetable-oil-producing continents and Asia, Africa, and South America are surplus oil-producing regions. Vegetable-oil production in both Europe and North America is very large but is not sufficient to supply domestic demands. Some countries have a surplus of one or more oil crops as, for example, olive oil in Spain and the earlier surplus of linseed in Canada. These and other individual surpluses account for the net exports for Europe and North America shown in table 3.

Within Asia, India has a very large production of vegetable oils and exports considerable quantities of flaxseed and peanuts but must import large quantities of other oils crops to supply its huge and growing population. China with its vast millions of people is nearly in the same situation and with some industrialization it is likely to become an importer of vegetable oilseeds and may absorb much of the Manchurian surplus.

Table 2.- Average net export of major vegetable oil crops in terms of oil equivalent from leading producing countries for selected periods

Crop	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Tree crops:					
Coconut	386	802	913	1,060	1,260
Palm	121	215	279	445	640
Palm kernel	147	241	250	310	335
Olive	116	138	147	121	136
Babassu	--	12	6	12	30
Tung	2/ 32	55	62	78	100
Total	802	1,463	1,657	2,026	2,501
Annual field crops:					
Cottonseed	247	142	114	163	201
Soybean	156	398	534	404	480
Peanut	221	546	612	681	805
Flaxseed	568	700	659	644	780
Sesame	132	48	80	68	76
Rapeseed & mustard	132	80	53	41	60
Sunflower seed	14	22	37	29	45
Perilla	--	4	11	52	30
Castor bean	--	--	70	88	100
Total	1,470	1,940	2,170	2,170	2,577
Grand total	2,272	3,403	3,827	4,196	5,078

1/ Estimate by writer for a year about 1955.
2/ Export data for 1914 to 1918.

Source: Derived mainly from data published by the International Institute of Agriculture, Rome.

PRODUCTION TRENDS BEFORE THE WAR

The trend in world production and export of vegetable oils was sharply upward before the war. By selected 5-year periods the world average totals for the major oil crops in terms of oil equivalent were as follows:

Period Average	Net Exports Million metric tons	Production Million metric tons
1909-13	2.3	8.5
1924-28	3.4	11.3
1929-33	3.8	12.6
1934-38	4.2	13.3
About 1955	5.1	17.4

Table 3.- Average net export of major vegetable oil crops in terms of oil equivalent by leading countries and for selected periods

(Approximate distribution by countries of origin)

Country	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Europe (includes USSR)	139	147	110	131
Africa				
French West and Equatorial Africa	188	173	244	299
French Cameroons	20	24	27	29
Algeria and Tunisia 2/	30	47	45	50
Nigeria	287	322	383	399
British East Africa 3/	23	27	40	50
Belgian Congo	50	67	97	205
Egypt	57	52	63	60
Others	173	163	163	156
Total	828	875	1,062	1,248
Asia				
China (including Formosa)	215	291	187	246
Manchuria	357	494	513	504
Korea	28	26	19	2
India 4/	371	379	366	460
Ceylon	99	98	106	110
Netherlands East Indies	278	371	525	625
Malaya	70	84	131	213
Japan	7	9	16	10
Oceania 5/	60	67	76	160
Philippines	239	277	344	450
Asia Minor 6/	8	15	13	16
Others	70	68	81	36
Total	1,802	2,179	2,377	2,832
North America				
United States	24	15	1	35
Canada	28	2	—	—
Mexico	3	—	—	—
Central America	8	10	5	—
Total	63	27	6	35
South America	571	599	640	832
Grand total 7/	3,403	3,827	4,195	5,078

1/ Estimate by writer for a year about 1955. 2/ Includes French Morocco. 3/ Uganda, Kenya, Tanganyika, and Anglo-Egyptian-Sudan. 4/ Includes French India. 5/ Solomon and Fiji Islands and New Guinea. 6/ Turkey, Syria, Lebanon and Palestine. 7/ Does not include a few countries with small production.

Source: Derived mainly from data published by the International Institute of Agriculture, Rome.

Discussion of the projected estimate for 1955 is reserved for the moment, while attention is directed to the past changes. The trend in production of individual oil crops is shown in table 4. Production data for several tree crops is inadequate, but it is evident that this group has increased proportionately more than the field oil crops from 1909-13 to 1934-38. The increase in tree oils is, of course, primarily a result of the development of palm oil and coconut plantations in Southeast Asia and the Southwest Pacific. Among the field crops the greatest increase took place in peanuts which apparently more than tripled during the period covered. The increases shown for individual oil crops are probably exaggerated to some extent as a result of the constant improvement in the coverage of the statistical data during this period.

Examination of the detailed data by countries in table 5 reveals that the United States was the only large producing country in which an increase in production did not occur between 1924-28 and 1934-38. Reduction in the domestic acreage and production of cotton prevented an increase and soybean production in this country had not yet come in to replace the reduced oil output. Nationalistic policies in Europe increased production there about one-third during this period.

Figure 1 shows the trend that has occurred in the several parts of the two broad producing regions, Southeast Asia and Central and West Africa, where most of the increase in exporting areas took place. The aggregate increase was greater in Southeast Asia than in Africa.

In terms of specific oil crops most of the prewar increase in net exports has been in coconuts, palm, palm kernel, and peanuts which are grown in these two regions. The expansion in the production of the tropical oil crops is mainly predicated upon their large yields and constantly improved transportation facilities.

Relative Yields of Tropical Oil Crops and Temperate Oil Crops

Tropical oil crops have very high yields per acre as compared with the oil crops grown in the temperate zone. This is particularly true under the plantation system which has been so successful in the production of palm oil in the Netherlands East Indies and British Malaya. Before the war began the plantation system of production was also introduced in the palm and palm kernel areas of Africa in which the expansion has been particularly great, especially in the Belgian Congo. The yield in this area is still considerably below that obtained in Sumatra where most of the Netherlands Indies palm-oil plantations are located. An idea of the comparative yields of oil obtained from palm and coconut plantations and from soybeans and peanuts in the United States may be had from table 6.

Table 4.- Average production of major oil crops in terms of oil equivalent in leading producing countries and for selected periods

Oil crop	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Tree crops:					
Coconut 2/	386	802	914	1,060	4/ 2,970
Palm 3/	300	475	539	745	940
Palm kernel 2/	147	241	250	310	420
Olive	590	753	845	869	905
Babassu 2/	--	12	6	12	55
Tung 2/	32	55	62	78	150
Total	1,455	2,338	2,616	3,074	5,440
Annual field crops:					
Cottonseed	1,466	1,729	1,712	2,009	2,250
Soybean 5/	1,575	1,702	1,941	1,791	2,460
Peanut 6/	1,000	1,746	2,418	2,370	2,804
Flaxseed	959	1,300	1,218	1,166	1,423
Sesame	7/ 330	664	768	693	754
Rapeseed & mustard 8/	1,515	1,363	1,245	1,345	1,350
Sunflower seed	165	503	592	9/ 589	690
Perilla 2/	--	4	11	52	50
Castor beans	--	--	104	179	243
Total	7,010	9,011	10,009	10,194	12,024
World total 10/	8,465	11,349	12,625	13,268	17,464

1/ Estimate by writer for a year about 1955.
2/ Exports only except for 1955 which include both exports and estimated domestic consumption.
3/ Palm oil consumption in Africa estimated as 180,000 tons in 1909-13; 260,000 tons in 1924-28 and 1929-33; 300,000 tons in 1934-38, and 1955.
4/ Production for 1955 includes the estimated home consumption in countries of production, while figures for earlier years represent net export only (see also table 7).
5/ Production in China estimated at 720,000 metric tons of oil in 1909-13; and 825,000 metric tons in 1924-28.
6/ Production in China for 1924-28 estimated at 540,000 metric tons in terms of oil. The 1909-13 production estimated by writer.
7/ Incomplete.
8/ Production of seed in China estimated at 2,700,000 metric tons in 1909-13 and 2,600,000 metric tons in 1924-28; oil content 35 percent.
9/ Three year average.
10/ Does not include a few countries in which production is small and the data inadequate.

Source: Derived mainly from data published by the International Institute of Agriculture, Rome.

Table 5.- Average production of major oil crops in terms of oil equivalent by leading producing countries and for selected periods 1/

(Approximate distribution by countries of origin)

Country	Average 1924-28	Average 1929-33	Average 1934-38	1955 2/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Europe (includes U.S.S.R.)	1,580	1,889	2,072	2,216
Africa				
French West & Equatorial Africa	266	283	329	444
French Cameroons	28	41	48	56
Algeria and Tunisia 3/	60	84	68	79
Nigeria	464	488	557	584
British East Africa 4/	33	53	84	131
Belgian Congo	100	153	205	266
Egypt	105	108	124	119
Others	157	160	178	325
Total	1,213	1,370	1,593	2,004
Asia				
China (includes Formosa)	2,878	3,350	3,138	3,467
Manchuria	670	740	674	825
Korea	81	84	83	97
India 5/	1,741	1,859	1,895	2,650
Ceylon	100	98	108	210
Burma	—	74	74	114
Netherlands East Indies	348	451	619	1,224
Malaya	69	84	131	285
Japan	84	82	94	104
Oceania 6/	61	70	78	237
Philippines	239	277	343	650
Asia Minor 7/	47	59	81	90
Others	171	181	157	197
Total	6,489	7,409	7,475	10,150
North America				
United States	1,249	1,162	1,169	1,771
Canada	53	23	11	22
Mexico	22	20	32	45
Central America	11	13	8	23
Total	1,335	1,218	1,220	1,861
South America	732	739	908	1,233
World total 8/	11,349	12,625	13,268	17,464

1/ Estimates of production for some countries and crops as shown in footnotes of table 3. 2/ Estimate by writer for a year about 1955. 3/ Includes French Morocco. 4/ Uganda, Kenya, Tanganyika and Anglo-Egyptian Sudan. 5/ Includes French India. 6/ Solomon and Fiji Islands and New Guinea. 7/ Turkey, Syria, Lebanon and Palestine. 8/ Does not include a few countries in which production is small and statistics inadequate.

Source: Derived mainly from data published by the International Institute of Agriculture, Rome.

AVERAGE NET EXPORT OF THE MAJOR OIL CROPS FROM SIX LEADING AREAS FOR SELECTED PERIODS AND AN ESTIMATE FOR A YEAR ABOUT 1955

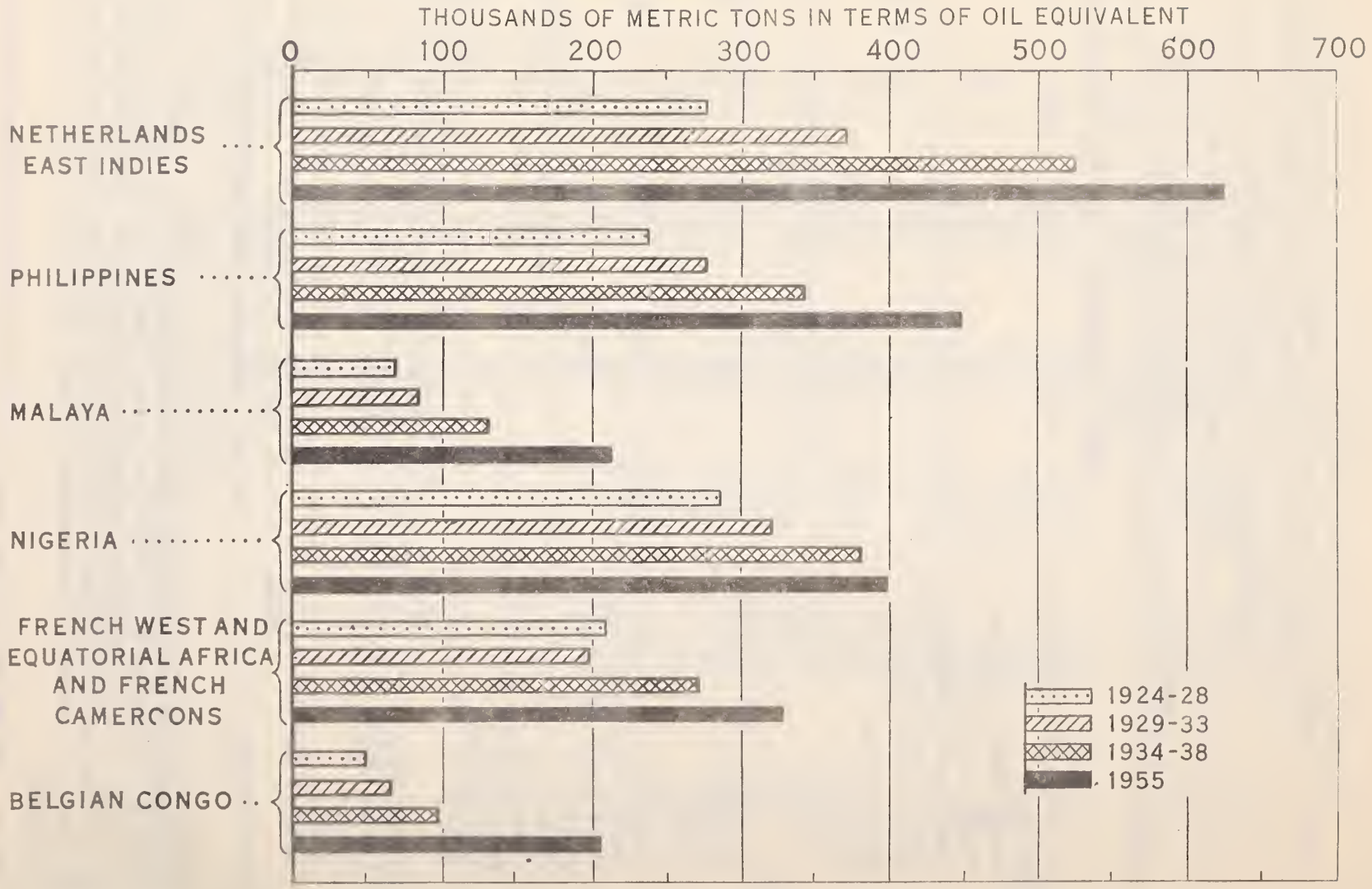

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FIGURE 1

Table 6.- Average yield per acre of vegetable oil from selected oil crops

Crop	Year	Country or area	Total area in production	Yield per acre
			Acres	Pounds
Palm	1936	Netherlands E. Indies	167,774	1/ 2,503
Coconuts	1932	Philippine Islands	924,000	2/ 730
Soybeans	1944	Illinois	3,470,000	189
Peanuts	1942	North Carolina	270,000	357

1/ Includes 200 pounds of palm kernel oil. This figure is based on data from 43 plantations in the Netherlands East Indies as reported in "Oils and Fats: Production and International Trade," p. 224. International Institute of Agriculture, Rome, 1939.
2/ Only the area of trees in bearing was used in arriving at this average yield. Individual plantation yields of as much as 1200-1400 pounds of oil per acre are not unusual.

The palm-oil yield is computed directly from the annual production of all plantations in bearing in the Netherlands East Indies. Some trees are reported not to have been in full bearing and to the extent this is true the average yield may be expected to increase.

Yields of coconuts under the plantation type of management compare favorably with the yields obtained on the oil-palm plantations. A direct comparison for any large area is difficult, however, since 80 to 90 percent of the coconuts are produced in small groves owned by natives while palm oil in the East is produced almost entirely on plantations under European management. It is therefore more appropriate to use the average yield from the total acreage of trees in bearing. This has been done for the production in the Philippine Islands for the year 1932 and shows an average yield of 730 pounds of oil equivalent per acre. Average yields per acre in the Netherlands East Indies and in some other areas are probably somewhat higher as the coconut palm is reported in many instances to be planted around the rice paddies and between individual fields.

The yields of both palm oil and coconut oil are greatly in excess of those obtained from domestically produced oil crops in the United States. The highest yielding of these is peanuts, which produces only about one-half as much oil as is obtained from coconuts in the Philippines and less than one-seventh of the per acre yield of palm oil and palm kernel oil combined in the Netherlands East Indies. Despite the long transportation from Southeast Asia to the United States coconut oil and palm oil seem to hold a definite advantage in relative cost (aside from costs arising from trade restrictions) over temperate-zone oils which can be used for similar purposes. In the case of peanuts the situation is somewhat different as they are mainly used in the United States as roasted peanuts, salted peanuts, peanut butter, and in candy, rather than as oil. Only the lower grades of peanuts

are used in producing oil although occasionally a large crop makes it necessary to utilize also some of the higher grades of edible peanuts for this purpose.

IMPACT OF THE WAR

The impact of the war on the oils and fats situation was first felt on the demand side, as the needs of war multiplied the uses of oils for food and industrial purposes. Supplies were plentiful at first but the entry of Japan into the war changed this by cutting off from the United Nations the access to perhaps 40 percent of the world's export supplies of vegetable oils. Whaling operations practically ceased because of submarine attacks and the later shortage of whaling equipment and crews.

The German conquest of France and western Europe, furthermore, placed refineries and processing plants in Axis hands while connections with colonial sources of oil supplies were severed. Production of peanuts in French Africa, for instance, was greatly retarded.

On the other hand, oil-crop production in areas under the control of the United Nations was greatly stimulated. In the United States, South America, and Central Africa especially, there were large increases in output. Even in blockaded Europe, oil crops were expanded. Adequate data are difficult to place together but it is estimated by Purves that world production of "edible" vegetable oils in 1942 and 1943 (outside of Japanese occupied areas) had increased to a level of 123 percent of prewar. 1/ Much higher increases for North and South America are estimated.

The permanent effects of the wartime influences are difficult to measure. It is to be noted that increases in output were obtained under the stress of exceptional prices and under the pressure of patriotism and other war motives. The removal of these special incentives will bring some recession in output in the areas of higher costs.

Two of the outstanding developments, expansion of soybeans in the United States and oil palm cultivation in Central Africa, will certainly have permanent effects. The soybean development was already underway when the war gave it a great forward impetus. Reconversion and adjustment to a lower relative price situation will still mean a soybean acreage much above prewar in the United States.

The new oil-palm plantings, begun before the war in Central Africa, are likely to represent permanent additions to the world's oil-crop production with no downward adjustment in prospect.

The Southwest Pacific areas which have been under Japanese control may have suffered from neglect, and probably not many new plantings have been

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1/ Purves, C. M., Wartime Changes in Food Production, U. S. Office of Foreign Agricultural Relations, 1944. (Processed.)

made during the war. However, little permanent damage is likely to have been done. The relatively high prices which are likely to prevail during the reconversion period will probably hasten restoration to more normal conditions and encourage further expansion.

PROSPECTIVE TRENDS IN PRODUCTION

Quantitative estimates of average annual oil-crop production about a decade from now, or about 1955, have been made for each oil crop in accordance with the assumptions stated earlier. 2/ These are shown in detail in the discussion of individual oil crops. These estimates are not forecasts, but they may be useful in getting an idea of the probable dimensions of the problem.

In terms of oil equivalents the projected estimates show an increase in net world exports of about 21 percent over 1934-38 as compared with an increase of about 23 percent during the previous decade. Examination of the factors favoring expansion or retrenchment for each of the major oil crops leads to the conclusion that the major factors will be the same as those that were operating in the period before the war. Southeast Asia, Central and West Africa, and possibly Brazil, remain the areas of greatest unexploited comparative advantage in vegetable-oil production. The prewar influences are still at work, plus additional factors that point in the same general direction. The colonial plantation system with its special advantages seems capable of extension. Additional improvements in varieties and management practices are highly probable. In Africa there appear to be great potentialities in increasing palm-oil production from small-scale native operations, which bulk very large in the total African output of oil. Improvements in the native methods of palm-oil extraction would result in a considerably greater yield of oil from the same basic production.

Extensive wartime plantings of the oil palm in the Belgian Congo will come into bearing before 1955, and further plantings may be anticipated. In the Philippines it appears that additional production may also come from prewar plantings of coconuts and improved care and management of existing groves.

The somewhat less favorable outlook for natural rubber in the Netherlands East Indies and British Malaya seems to favor greater vegetable-oil production. Plantation management is similar and capital may readily flow from one to the other. This may be furthered by the probability that prices for oil will stay at relatively higher levels during the reconversion period than prices for raw rubber.

2/ The year 1955 is not to be taken literally - rather it is meant to be a year after reconversion is completed, when production may be considered to have returned to a stable level.

The wartime expansion in the Americas will undoubtedly recede to some extent, especially where it has been on a relatively high cost basis. Flaxseed may expand in Argentina as wartime difficulties with shipping fade away and as North American production is adjusted downward.

WORLD EXPANSION AND THE UNITED STATES

What does an expanded world production of vegetable-oil crops mean to the United States? If the international conversion from war to peace is reasonably prompt around the world, and if peaceful relations and a reasonable movement of trade among nations continue, it is quite possible that a very large output of vegetable oils will be needed and consumed despite the probable decrease of buying power in Europe as compared with prewar levels. The world's population is still growing, and all signs point to rapid economic progress in some of the less developed areas of the world if opportunity now offers. Vegetable-oil consumption in China and Russia may rise greatly above prewar levels. Accordingly, an increase of 21 percent by 1955 in vegetable-oil exports may be well within the world's consuming capacity even if whale oil should regain its prewar position of about one billion pounds produced annually. However, the average world prices of the vegetable oils moving in international trade may come to lower levels as the relative proportion of the tropical oils entering export trade continues to rise.

The realignment of world powers resulting from World War II must be considered in relation to the vegetable oils, if the position of the oil crops in the United States is to be fully understood. The colonial development of the tropical oils has always been related to the national policies of the European powers. The United States came into the picture through the Philippines. Before World War II it appeared that this country was preparing to move away from this connection. But one of the obvious facts of the new state of affairs is that the United States is in the Pacific to stay for a long time to come.

Many of the new Pacific bases have coconuts which must be given a market. Their aggregate production is small, however, until we come to the Philippines. The arrangements that will govern our trade with the Philippines remain to be worked out in connection with the coming independence of the Islands but, judging by the precedent of Cuba, we may continue to give the Philippines preferential treatment in our markets.

It is not possible at this time, of course, to foresee with any degree of accuracy what the future policy of the United States will be. But, judging from steps already taken toward aiding the expansion of international trade, at such important international conferences as those held at Hot Springs, Bretton Woods, at Dumbarton Oaks, and at San Francisco, and such positive action as the extension of the Reciprocal Trade Agreements Act for another 3 years with provision for further reduction in tariffs, it

appears reasonable to assume that there will be fewer restrictions on foreign trade than there were before World War II.

The result of greater freedom of trade so far as oils and fats are concerned would provide the economic basis for an exchange of larger quantities of these oils between the producing countries. It would no longer be advantageous for India, for example, to use linseed oil for food purposes if it could be sold abroad at a higher price than equally or more desirable food oils could be imported.

Over-all imports and exports of oils and fats to and from the United States, by 1955, may be little different from prewar quantities. Food oils and fats, of which we have an adequate production for domestic use, are not likely to be imported on a large scale unless the production of cotton and soybeans should decline materially. Industrial oils that have been imported for a long time are expected to continue to be imported with few, if any, additional tariff barriers. This basic position will probably be changed only as full employment materializes and as economic conditions permit.

INDIVIDUAL OIL CROPS

In the following pages each of the major oil crops is considered separately. The discussion covers past trends, current changes, and prospective developments. Figure 2 shows a summary of the trends for eight of the more important oil crops.

Coconuts, Copra, and Coconut Oil

The coconut palm is one of the world's most important sources of food. In the areas where it is grown coconut products are used not only for food but also to provide building and clothing materials and to make household equipment. The importance in the rest of the world depends primarily upon the coconut oil which is valuable in food products such as margarine and shortening, and in the manufacture of soap, in which it is particularly desired because of its high lauric-acid content.

In world trade the most important products of the coconut palm are copra and coconut oil. Copra is the kernel of the coconut prepared by drying and otherwise, so it may be shipped with a minimum of spoiling. After the oil has been pressed from the copra, the residue provides an excellent feed for livestock.

The growing importance of coconut oil in world trade since the first World War is largely a result of improved transportation and the rapid development of the margarine and soap industries which together have increased the world demand for this vegetable oil. A factor in the ability of

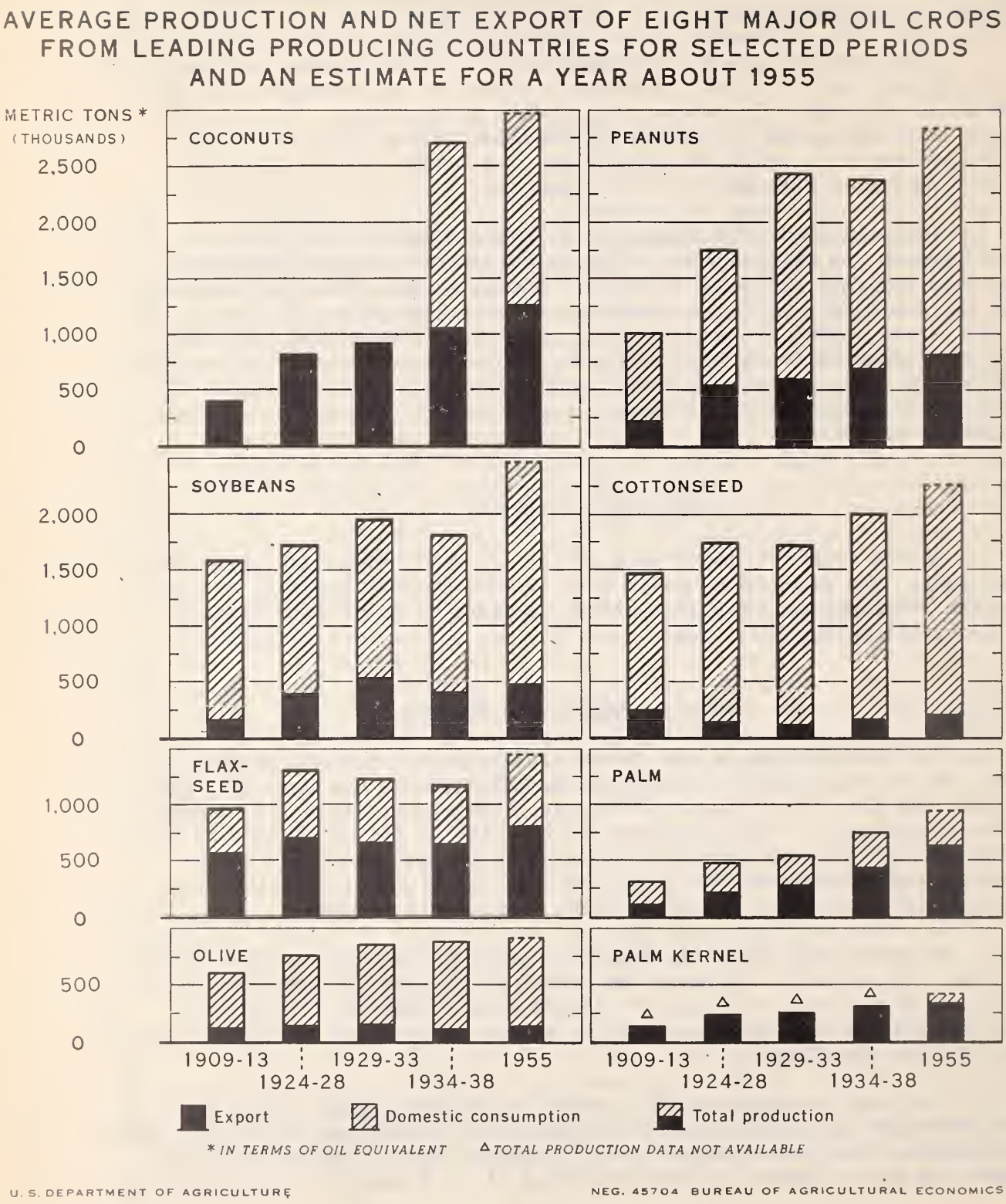

Figure 2.- Average production and net export for eight of the major oil crops entering international trade for selected periods. Indicated production for coconuts, palm kernels, and palm oil are estimates based upon incomplete data.

the tropical areas to increase production in response to the demand has been the development of the plantation system of production. Under this system large areas planted in coconut palms are operated efficiently under scientific methods of management. The yield in mature plantations at times reaches 800 to 1,200 pounds of oil per acre, or twice as much as in small groves. However, the principal part of the annual production of coconuts originates from small groves owned mainly by natives. These provide 80 to 90 percent of the world total production. There is considerable variation in the annual output from these small groves, depending upon prices and the need of the local population for goods that they are not able to produce themselves.

In examining historical trends in world production of coconuts, main reliance must be placed on the export statistics for copra and coconut oil because of the limited data available regarding production. Information is particularly lacking with respect to that part of the production which is consumed locally and estimates of the per capita consumption even for the same area differ widely. On the basis of available information it seems that considerably less than half of the world's production is exported.

The principal areas of coconut production and export are the Netherlands East Indies, the Philippine Islands, Oceania, Ceylon, and Malaya. These areas provided 93 percent of the copra and coconut oil that entered world trade during the period 1934-38. Other areas, such as India, Burma, French Indo-China and Siam are important as producers of coconuts but do not export many. In fact, India is a heavy importer of coconuts and coconut products, chiefly from Ceylon.

On the basis of limited and in some cases conflicting data an estimate of prewar production of coconuts in terms of oil equivalent and an estimate for the period about 1955 are presented in table 7. The prewar estimate is based largely upon data obtained from "Copra and Coconut Oil" by Katharine Snodgrass. 3/ Also helpful were "The Coconut Industry" by M. M. Kalaw 4/ and a doctor's thesis "Die Kokospalme" by Werner Schrotter, Glauchau, Germany, 5/ as well as data published by the International Institute of Agriculture. 6/ A discussion of the estimated production in

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3/ Snodgrass, Katharine. "Copra and Coconut Oil," 135 pp. illus. Food Research Institute, Stanford University, California, 1928.

4/ Kalaw, M. M. "The Coconut Industry," 140 pp. illus. (A Special Coconut Mission Abroad in Pursuance of Resolution No. 23 of the National Assembly.) Bureau of Printing, Manila, 1940.

5/ Schrotter, Werner. "Die Kokospalme" Eine Wirtschaftsgeographische Studie, 178 pp. illus. Liegnitz, 1933.

6/ International Institute of Agriculture. Oils and Fats, Production and International Trade, Part I, pp. 165-199. Rome, 1939.

Table 7.- Estimated production of coconuts in terms of oil equivalent by leading producing countries prewar and about 1955

Country	Prewar 1/	1955 2/
	1,000 metric tons	1,000 metric tons
Asia		
Philippines	570	650
India including Burma	525	550
Ceylon	230	210
Malaya	165	190
French Indo-China	25	30
Siam	20	25
Netherlands East Indies	760	820
New Guinea (all)	75	110
Oceania	110	125
Others	30	40
Total	2,510	2,750
Africa 3/	130	170
America 4/	35	50
World total 5/	2,675	2,970

1/ Data used cover mostly single years varying from 1933 to 1938.
2/ Estimate by writer for a year about 1955.
3/ Chiefly Mozambique, Zanzibar and other parts of East Africa.
4/ Chiefly Mexico and the Caribbean area.
5/ This total does not include the scattered production in countries where coconuts are not of commercial significance.

some of the principal producing areas is given at the end of this section of the report. The domestic consumption in each of the producing countries is the chief factor of uncertainty in ascertaining the annual production.

The leading production area in the world for coconuts is the Netherlands East Indies with the Philippine Islands and India in second and third place. Although second in production, the Philippines rank first in export of coconut products and the Netherlands East Indies are second as a result of the heavy per capita consumption by the large population. India is a net importer of coconut products. Export of coconut products from the Philippines increased from an average of 239 thousand metric tons in terms of oil equivalent during the period 1924-28 to 344 thousand metric tons in 1934-38. The export from the Netherlands Indies increased from 240 thousand to 323 thousand metric tons during the same period. Exports for 1939 were 75 thousand higher from the Philippines and only 16 thousand higher from the Indies.

The percentages of the world total export for each producing country during the 5-year period 1934-38 were as follows:

Country	Percentage of world net exports Percent
Africa	4.1
Central and South America	.5
Asia	
New Guinea	4.0
Solomon Islands	1.3
Fiji Islands	1.8
Other Pacific Islands	5.3
Philippines	32.4
Netherlands East Indies	30.6
Malaya	8.9
Ceylon	10.0
Other	1.1
World total	100.0

The greatest proportionate increase in export during the last 30 years has been in Malaya, New Guinea, and the Philippine Islands. All of these areas exported from four to five times as much in 1934-38 as during the 1909-13 period while the export from the Netherlands East Indies only was a little more than twice as high. Average export by 5-year periods is shown by countries in table 8.

Table 8.- Average annual export of copra and coconut oil in terms of oil equivalent from leading producing countries by selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Africa	13.9	29.9	34.7	43.5	50
Oceania					
New Guinea	8.1	29.8	39.1	42.9	60
Solomon Islands	2.8	13.2	14.0	14.0	22
Fiji Islands	8.6	16.6	14.3	18.9	18
Others	23.1	47.3	51.2	56.0	60
Total	42.6	106.9	118.6	131.8	160
Asia					
Philippines	80.1	238.7	277.2	343.5	450
Netherlands East Indies	146.9	240.4	284.0	323.0	350
Malaya	21.4	68.0	77.6	94.8	120
Ceylon	53.4	99.5	98.3	106.2	110
Others	27.2	10.8	12.9	12.3	20
Total	329.0	657.4	750.0	879.8	1,050
Central America	.4	7.9	10.3	5.1	—
World total 2/	385.9	802.1	913.6	1,060.2	1,260

1/ Estimate by writer for a year about 1955.
2/ Report of whole nuts not included.

Source: Based on data published by International Institute of Agriculture and Agricultural Statistics of League of Nations. Oil equivalent computed on basis of copra and 63 percent oil content.

Expansion in coconut production and export is likely to continue during the postwar years. It is reported that undeveloped areas in the Philippines, Malaya, and the Netherlands East Indies are suitable for cultivation of coconuts. 7/ Additional lands are available in New Guinea, the Solomon Islands, and elsewhere. Thus it seems possible to expand coconut production by adding more land in some areas, but the maximum expansion has probably been reached in Ceylon and many of the small Pacific Islands.

Judging from experience on the plantations, the really great opportunity for increased production of coconuts seems to lie on the intensive margin. Improved standards of cultivation and more general use of fertilizers could probably double the output from the native groves. These improvements depend perhaps on a higher level of education and income. This may be a slow process as apparently very little progress has been made toward getting the small growers to adopt more modern practices.

Before the war began many of the plantations in the Philippines had not yet reached maturity and full production. As relatively little war damage to the coconut trees has been reported it is likely that the Philippine Islands may exceed prewar production within a few years. 8/ Unofficial estimates place the production of copra at 800 thousand metric tons within a few years after the end of the war and at a potential 900 thousand metric tons at the end of the reconstruction period. 9/ The increase in production in the Netherlands East Indies, Malaya, and other areas may also be considerable but the increase in exports is not expected to be so large as in the Philippine Islands (table 8). International trade in coconut products may be favorably affected by an increased freedom of trade. The export about 1955 could therefore easily be 15 to 20 percent higher than the average during 1934-38.

Additional Explanation of the Estimates.- Coconut production in the Philippine Islands has been estimated on the basis of the number of trees. These were reported to total 114 million in 1933 and about 121 million in 1937. The production per tree is variously estimated at from 30 to 40 nuts. If an average of only 32 nuts per tree is used, with an estimated 6,700 nuts per metric ton of oil, a production of 578 thousand tons is obtained. As about 30 million additional trees had not reached maturity in 1937, the estimated increase of about 14 percent or a production of 650 thousand metric tons in terms of oil by 1955 appears to be conservative.

7/ Snodgrass, Katharine. Copra and Coconut Oil p. 72.
8/ Kalaw, M. M. The Coconut Industry p. 100.
9/ Estimates received from the Philippine Islands by the Office of Foreign Agricultural Relations, USDA. 1945.

Estimates of production in the Netherlands East Indies rest on somewhat less adequate data than those for the Philippine Islands. The 1937 production of copra in Java and Madura was reported as 215 thousand metric tons exclusive of local consumption. In the outlying islands of Celebes, Borneo, etc., production of copra was estimated as about 520 thousand metric tons annually. 10/ This quantity of copra represents a total of 460 thousand metric tons in terms of oil of which the equivalent of about 350 thousand metric tons were exported and 100 thousand metric tons consumed domestically. Estimates of the total domestic consumption of coconuts and coconut products by the population of the Netherlands East Indies vary greatly. The most reliable estimate seems to be one made in the 1920's by the Department of Agriculture of Java and Madura. It shows a total consumption of only 21.34 pounds per capita in terms of copra equivalent. 11/ Based on a prewar population of some 62 million this would mean a home consumption of coconut products equal to about 400 thousand metric tons of oil. Included in this total are about 100 thousand metric tons of industrially produced oil leaving about 300 thousand tons in nuts, home-produced oil, and other coconut products. The total production thus arrived at equals the 760 thousand metric tons shown in table 7. 12/

Exports from Ceylon over a 10-year period averaged more than 130 thousand metric tons in oil equivalent. Domestic consumption of coconuts and coconut products is high and is estimated to average 130 to 150 nuts per capita or 100 thousand metric tons annually in terms of oil. As the area devoted to coconuts is reported to be close to a million acres the data for home consumption are probably about correct.

The data regarding coconut production in India are limited. Total acreage in coconuts in British India is reported at 650 thousand while the total in all of India including Burma is estimated by M. M. Kalaw to be more than 1,400 thousand acres. 13/ This acreage is approximately the same as given by Snodgrass for 1924-25. 14/ Production probably does not average over 3 thousand nuts per acre. As the nuts are somewhat smaller than in the Philippines it may take about 8 thousand for one metric ton of oil. This would give an annual production in India including Burma of 525 thousand metric tons in terms of oil.

10/ Kalaw, M. M. The Coconut Industry, p. 3.
11/ Snodgrass, Katharine. Copra and Coconut Oil, p. 51.
12/ An article in "Foreign Commerce Weekly," U. S. Department of Commerce, Sept. 15, 1945, p. 50, indicates a total 1938 production of copra in terms of oil of 535 thousand metric tons of which about one third was consumed as oil in the Islands. This estimate of production does not include the home consumption and export of nuts.
13/ Kalaw, M. M. The Coconut Industry, p. 33.
14/ Snodgrass, Katharine. Copra and Coconut Oil, p. 42.

In Malaya the area planted in coconuts in recent prewar years is given as 640 thousand acres. Even in 1925 it was about 510 thousand acres. Production data are extremely difficult to get as coconuts are grown in conjunction with rubber which is the main crop. Annual production is estimated at 165 thousand to 200 thousand metric tons in terms of oil, a third of which appears to be consumed by the 10 million people there.

Peanuts and Peanut Oil

Peanut oil is used for food purposes in margarine, in shortening, and in table oils. In the last case it is often used instead of olive oil or it is mixed with olive oil. Peanut oil is usually too costly for extensive industrial uses. In the United States, India, and China, but not in Europe, large quantities of peanuts are consumed as food. In the United States peanuts are used also in such products as peanut butter, peanut candy, shelled salted peanuts, and peanuts roasted in the shell.

World production of peanuts has shown a sharp upward trend since before the first World War and in terms of oil equivalent peanuts frequently have been the largest single oil crop. The total potential oil yield of the crop is close to that of cottonseed. The principal peanut-producing areas are India, China, French West Africa, and the United States, in the order mentioned. These countries provide about 85 percent of the world total production while a number of smaller countries make up the remaining 15 percent (table 9).

About one-third of the production of peanuts enters the world market and is mostly crushed for oil. The principal exporting countries during the period 1934-38 were India, French West Africa, China, and Nigeria. The United States, although a large producer, frequently imports small quantities of peanut oil and at one time imported fancy edible peanuts from China. 15/ The world export of peanuts and peanut oil is largely absorbed by European countries especially France, Germany, and the United Kingdom. Germany gradually reduced its import of peanuts before the war in favor of increased imports of soybeans and whale oil.

The future production and trade in peanuts and peanut oil will doubtless be influenced by the difference in its conditions of production as compared with other fats and oils. This difference is particularly marked in comparison with tree oils obtained from permanent investments made in plantations and perhaps even more so in comparison with byproducts, such as lard and cottonseed oil, in which the main product determines the continued production. A reduction in the annual production of peanuts can be brought about by shifting the land to something else more readily than is true for palm oil or coconut oil whenever more profitable alternatives exist.

15/ The import of edible peanuts to the United States from China was discontinued when the tariff was increased to 7 cents a pound in 1930.

Table 9.- World production of peanuts (unshelled) by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Europe	--	--	24.0	22.2	20.0
United States	194.0	384.0	400.3	538.9	700.0
Mexico	--	--	5.0	9.5	20.0
South America	--	65.1	83.5	87.6	100.0
Asia					
China	2/1,952.0	2/1,846.0	3,051.4	2,596.4	3,000.0
Burma	--	--	156.1	165.9	200.0
India 3/	607.0	2,200.0	2,636.9	2,700.2	3,200.0
Netherlands East Indies	35.0	212.0	224.7	240.8	300.0
Oceania	--	--	6.1	5.2	5.0
Others 4/	125.0	205.8	232.6	88.9	100.0
Total	2,719.0	4,463.8	6,307.8	5,797.4	6,805.0
Africa					
French West Africa	5/300.0	571.0	665.2	736.8	900.0
French Equatorial Africa	--	--	10.6	15.8	15.0
Nigeria	6/ 10.0	153.0	245.6	334.3	400.0
Cameroons	--	--	22.1	34.3	35.0
Egypt	--	--	15.4	15.1	15.0
Anglo-Egyptian Sudan	--	--	45.0	88.6	90.0
Tanganyika & Mozambique	30.0	6/ 35.0	6/ 40.0	6/ 40.0	45.0
Belgian Congo	--	58.0	96.2	78.5	100.0
Others 4/	80.0	90.1	99.9	102.6	100.0
Total	420.0	907.1	1,240.0	1,446.0	1,700.0
World total 7/	3,333.0	5,820.0	8,060.6	7,901.6	9,345.0

1/ Estimate by the writer for a year about 1955.
2/ Estimate for China (1909-13 and 1924-28) was made by the writer and includes Manchuria.
3/ Includes French India.
4/ Only export data available for some of these countries.
5/ Includes Gambia.
6/ Partly export data.
7/ Does not include production in a few countries with small production because of lack of data.

Source: Based on data published by the International Institute of Agriculture, Rome.

The rapid expansion in peanut production in the past is an indication of the growing demand for this oil crop and its favorable competitive position. Under reasonably favorable economic conditions this expansion will probably continue at a moderate rate. A larger consumption of peanut oil in the world as a whole may result from greater freedom of trade because of the superiority over many other oils for food purposes. An increase by about 1955 amounting to 12-18 percent over the average amount produced during the period 1934-38 is estimated. 16/ Simultaneously, there might be an increase of 10-15 percent in world exports (table 10). The increase expected in production and export are likely to be primarily in India and in West Africa. India may trade peanuts for palm and coconut oil while West Africa seems to hold a comparative advantage in the production of peanuts.

Palm Oil

Palm oil has become one of the world's principal vegetable oils during the last 30 years. It is obtained from the outer fleshy part of the fruit of the oil palm. The fruit also contains the kernels from which palm-kernel oil is obtained. The oil palm grows wild in large areas of Africa where palm oil apparently has been utilized by the natives from early times. After the first World War the production of palm oil spread to the Far East where a higher yielding oil palm had been found. Based on cultivation of this variety a number of highly successful plantations were established in the Netherlands East Indies, principally in Sumatra. Similar plantations were developed in British Malaya.

Thus there are now two major palm-oil areas, one in Africa and another in the Far East. The production of palm oil in the Netherlands East Indies and British Malaya is more commercialized than in Africa and nearly all the oil is produced for export. The plantation system of production, with the higher yielding palms and the improved method of handling the oil, is far more efficient than the small-scale native production in Africa. Recently Africa has increased in average efficiency as a result of using improved machinery to press the oil from the fruit, introduction of the plantation system in the Belgian Congo, and the planting of high-yielding oil palms as in the Netherlands East Indies. But the native production of palm oil and palm kernels in Africa is still much greater than that of the plantations.

The tremendous possibilities for the increased production of palm oil are perhaps best realized from data on production of oil per acre. In 1936 the Netherlands East Indies reported an average production of some 2,300 pounds of palm oil per acre. This did not include the additional yield of 200 to 300 pounds of palm-kernel oil.

16/ This production would actually be only about 10 percent over the best prewar years and if the production estimates for the United States materialize, the increase in other countries would need to be even lower.

Table 10.- Average net export of peanuts and peanut oil in terms of oil equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Asia					
China 2/	30.8	95.5	119.2	101.7	100.0
India 3/	90.8	207.3	228.1	245.9	300.0
Netherlands East Indies	7.2	9.0	9.0	13.9	20.0
Others	.4	.8	—	—	—
Total	129.2	312.6	356.3	361.5	420.0
Africa					
French West Africa 4/	81.6	128.1	120.8	176.7	225.0
Nigeria	2.1	45.0	68.8	93.7	105.0
Tanganyika & Mozambique	5.4	6.0	.9	.2	—
Belgian Congo	—	—	—	1.8	5.0
Others	2.4	54.7	65.0	45.7	50.0
Total	91.5	233.8	255.5	318.1	385.0
Latin America	—	—	—	1.0	—
World total	220.7	546.4	611.8	680.6	805.0

1/ Estimate by the writer for a year about 1955.
2/ China and Manchuria.
3/ Includes French India.
4/ Includes Gambia.

Source: Based on data published by the International Institute of Agriculture, Rome.

The average yields of palm oil per hectare for the Netherlands East Indies from 1931 to 1936 were reported as follows: 17/

Year	Kilograms per Hectare 1/
1931	1,780
1932	2,060
1933	2,232
1934	2,393
1935	2,369
1936	2,581

1/ One hectare = 2.471 acres. One kilogram = 2.2046 pounds

17/ International Institute of Agriculture. Oils and Fats. Production and International Trade, Part I, p. 224, Rome, 1939.

The maximum yield obtainable is probably even higher, as many plantations had not yet reached full maturity. These yields are particularly interesting when compared, for example, with those of soybean oil in the United States which average 171 pounds per acre (192 kilograms per hectare). Even when it is considered that the soybean oil represents but about one-half the value of soybeans for processing, (the oil meal is usually of nearly equal value), the comparative advantage seems to be with the palm oil. A further difference is, of course, that once the investment in a palm-oil plantation has been made it is costly to shift to something else, whereas the land in soybeans can be shifted rather quickly to some other crop.

In the principal producing areas of the world the possibilities for continued expansion of palm-oil production appear to be rather extensive. Moreover, the methods of production and preparation of the oil, especially in Africa, can be greatly improved, since apparently only a little more than one-half of the oil is being obtained by the natives with the methods now used.

Export of palm oil from the producing countries has shown marked increases during the last 20 years (table 11). These increases have been particularly rapid in the Far East where the export within the 5-year period 1934-38 was only slightly less than from the old producing areas in Africa where increases have also taken place. The relative importance of exporting countries during the period 1934-38 is shown below:

Country	Percentage of world net export
Asia	
Netherland East Indies	38.5
British Malaya	7.6
Africa	
Belgian Congo	13.6
French West and Equatorial Africa	5.9
French Cameroons	1.9
Nigeria	30.4
Others	2.1
World total	100.0

The increasing significance of the Far East and the Belgian Congo, compared with other areas, may be seen in table 11. The quantity of palm oil exported from the Far East during 1934-38 was almost eight times that of 1924-28, while the export from Africa during the same period increased only 27 percent. New plantations developed in the Belgian Congo and in the French African colonies, some of which are now in production, are expected to place Africa in a stronger competitive position during the

postwar period. On the other hand, the high yields of palm oil in the Netherlands East Indies and a relatively more stable labor supply seem to be factors in favor of the Far East.

Among the principal importers of palm oil before the war were the United States, the United Kingdom, Germany, and several other European countries. During the 5-year period 1934-38 the United States imported for consumption about 30 percent of the palm oil exported from the producing countries. The greater part of this oil was purchased in the Netherlands East Indies. European countries took nearly all of the rest.

The chemical characteristics of palm oil are quite different from those of palm-kernel and coconut oil. The principal difference is that palm oil does not contain lauric acid. Palm oil is utilized in the manufacture of soap and in the food industries especially in margarine and vegetable shortening. It is used for industrial purposes particularly in the manufacture of tin plate.

The postwar outlook for palm oil appears to be promising since the low cost price and general usefulness of the oil places it in a relatively strong competitive position. The upward trend in world production and trade in palm oil may therefore be expected to continue. Cultivation of the oil palm may spread to new areas during the next decade, stimulated by improved transportation facilities. Among the possible places where such expansion may occur are new areas in Latin American countries, for example in Brazil. Undeveloped areas in Malaya and the Netherlands East Indies may come into use, and further expansion may take place in Belgian Congo and perhaps elsewhere in Africa.

In Africa there is also a possibility for improving the methods used by the natives in the production of palm oil. It has been estimated that the palm fruit grown in all of Africa during the period 1924-28, if properly utilized, would have produced upward of 900 thousand metric tons of palm oil. 18/ About one-half of this quantity, or some 450 thousand tons, was extracted. Of this, 189 thousand tons were exported and 261 thousand metric tons were used for local consumption. According to the export data only a slight increase has taken place since 1924-28 although native consumption as a result of some new processes probably has increased to about 300 thousand metric tons annually. If the methods used to extract the palm oil were improved sufficiently to obtain even as much as two-thirds of the palm oil available in the fruit grown, it may be estimated that the annual export from Africa might increase by 100 thousand metric tons. The uncertainty of when such improvement may come about makes it impossible to include any such increase in our estimate for 1955.

18/ International Institute of Agriculture. Oils and Fats: Production and Trade. Part I, p. 216, Rome, 1939.

As a result of the new plantations already in operation in the Belgian Congo it is expected that the export of palm oil from this part of Africa will increase at a more rapid rate than export from the Far East during the next 10 years. Exports from other African areas by 1955 are likely to be close to those in the prewar period. War damage through neglect of plantations in the Far East may cause a lower volume of export of palm oil for a few years. By 1955, however, the production in old plantations should have recovered and additional new plantings should have begun to produce. It seems reasonable therefore to anticipate a total annual world export of 640 thousand metric tons about 1955. As compared with the prewar period, the rate of increase will be somewhat greater for Southeast Asia than for Africa, although the African production, when consumption by the native population is included, may remain well above that of the Far East for some time (table 11).

Palm-Kernel Oil

Palm-kernel oil is obtained from the kernel of the fruit of the oil palm. In contrast to palm oil, which is obtained from the outer fleshy part of the fruit and must be extracted near the point of production, the palm kernels are usually dried and exported. The kernels are imported mostly by countries that have adequate crushing and refining facilities and in which palm-kernel meal is in demand for feeding livestock.

The palm-kernel oil is similar in most respects to coconut and babassu oil and is generally in demand for the same purposes. It is used particularly by the soap industry, because of its lathering ability resulting from its high lauric acid content. It is also valuable in the food industries where it is used in margarine and other vegetable-oil preparations.

The data available on total world production of palm kernels are incomplete so it is necessary to depend on export and import data to obtain an estimate of the importance of palm kernels in relation to other oil-yielding crops.

The principal exporting sources of palm kernels are in Africa; they include Nigeria, Belgian Congo, and areas in Equatorial Africa, the Cameroons and French West Africa. The Netherlands East Indies and British Malaya have become exporters of palm kernels during the last two decades although not on the same scale as the producing areas in Africa. Table 12 shows the total export of palm kernels in terms of oil equivalent from each of the principal exporting countries or areas. The proportions of the world export of palm kernels coming from the principal producing countries during the 5-year period 1934-38 were as follows:

Country	Percentage of world net export
	Percent
Asia	
Netherlands East Indies	5.1
British Malaya	.8
Africa	
Belgian Congo	11.3
French West Africa	11.6
French Equatorial Africa	1.6
French Cameroons	6.0
Nigeria	47.1
Other	16.5
World total	100.0

Table 11.- Average net export of palm oil by leading producing countries for selected periods 1/

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 2/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Asia					
Netherland East Indies	--	25.2	69.6	170.9	3/ 226.0
British Malaya	--	1.2	6.0	33.9	85.0
Total	--	26.4	75.6	204.8	311.0
Africa					
Belgian Congo	2.1	19.2	39.0	60.2	150.0
French West and Equatorial Africa	19.2	24.7	20.0	26.5	29.0
French Cameroons	3.5	5.3	7.2	8.5	9.0
Nigeria	81.9	128.1	126.7	135.3	135.0
Others	14.2	11.3	10.6	9.4	6.0
Total	120.9	188.6	203.5	239.9	329.0
World total	120.9	215.0	279.1	444.7	640.0

1/ Net exports in Asia are nearly equivalent to total production. In Africa, however, domestic consumption is probably more than the quantity exported, amounting to about 300,000 metric tons annually in 1934-38, according to one estimate.
2/ Estimate by the writer for a year about 1955.
3/ Production as early as 1939 was reported to be more than 240,000 metric tons.

Source: Based on data published by the International Institute of Agriculture, Oils and Fats: Production and International Trade; and by the League of Nations.

Table 12.- Average net export of palm kernel in terms of oil equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Asia					
Netherland East Indies	--	1.3	6.3	15.9	22
British Malaya	--	.1	.4	2.5	8
Total	--	1.4	6.7	18.4	30
Africa					
Belgian Congo	2.9	30.5	27.8	35.1	45
French West and Equatorial Africa	21.1	35.4	33.0	40.9	45
French Cameroons	7.0	15.0	16.5	18.5	20
Nigeria	79.3	112.1	121.5	145.9	150
Others	37.1	46.4	45.0	50.9	45
Total	147.4	239.4	243.8	291.3	305
World total	147.4	240.8	250.5	309.7	335

1/ Estimate by the writer for a year about 1955.

Source: Based on data published by the International Institute of Agriculture and the League of Nations.

There are noteworthy differences between the production of palm kernels in Africa and in the Far East. In Africa the palm kernels are gathered from the wild stands of palm trees or are obtained as a sort of a byproduct from the production of palm oil. Annual production shows considerable variation depending upon the efforts of the natives in gathering the kernels and upon the annual production of palm oil. In contrast, the production of palm kernels in the Far East is more uniform from year to year owing to the commercialized methods used on the plantations owned by Europeans.

As a result of the recent establishment of large commercial plantations, particularly in Belgian Congo, the export of palm kernels from Africa is likely to increase during the coming years.

The yield of palm kernels per acre in the Netherlands East Indies is reported to average 400 to 500 pounds or about 200 pounds of palm kernel oil at 45 percent. 19/ The yield of palm kernels from mature oil-palm plantations is higher than this average. If the yield of palm-kernel oil is compared with the much higher yields of palm oil, it is recognized that palm-kernel oil in the Far East is in reality a byproduct. If similar production data were available from Africa it is probable that the palm-kernel oil would represent a relatively larger proportion of the combined yield as the oil palm growing wild in Africa yields much less palm oil than is obtained from plantations in the Far East.

The postwar outlook for the production of palm-kernel oil is closely associated with the production of palm oil. Since palm oil is likely to hold a strong competitive position because of its relatively low cost, particularly in a world with lowered trade barriers, the production of palm-kernel oil may be expected to increase with that of palm oil although perhaps at a lower percentage rate because improved technology apparently has a greater effect on palm-oil production.

Soybeans and Soybean Oil

Soybeans, long one of the most important foods in the Far East, have become an important food, feed, and industrial crop in the Western World since the first World War. Research in recent years indicates the possibility of fractionating soybean oil and so obtaining both a high-grade food oil and an improved drying oil. Soybean oil is used in the manufacture of shortening and margarine although other vegetable oils frequently are preferred. Soybean oil meal, a high protein product is used largely for livestock feed. Soybean flour in recent years, has been used to some extent in bread, pancake flour, and an increasing list of food preparation.

Production of soybeans was concentrated primarily in China, Manchuria, and Korea until recent years. During the 1930's the United States became one of the world's largest producers and the cultivation of soybeans also spread to the Netherlands East Indies, the Soviet Union, and several of the Southeast European countries where the production was encouraged by Germany for political and economic reasons (table 13). Since the beginning of World War II, there has been a tremendous expansion in the acreage devoted to soybeans in the United States to offset in part the loss of tropical oils previously imported from the oil-producing areas controlled by Japan and to help supply the needs of the Allied Nations, (fig. 3). It is uncertain how much of this expansion in soybeans will be maintained now the war is over, as other sources of vegetable oils will again be available, but it is anticipated, in the 1955 estimate, that there may be some decrease in the United States from the heavy production records of soybeans during the war years.

19/ International Institute of Agriculture. Oils and Fats: Production and International Trade, p. 216. Rome, 1939.

Table 13.- Average production of soybeans by leading producing countries for selected periods

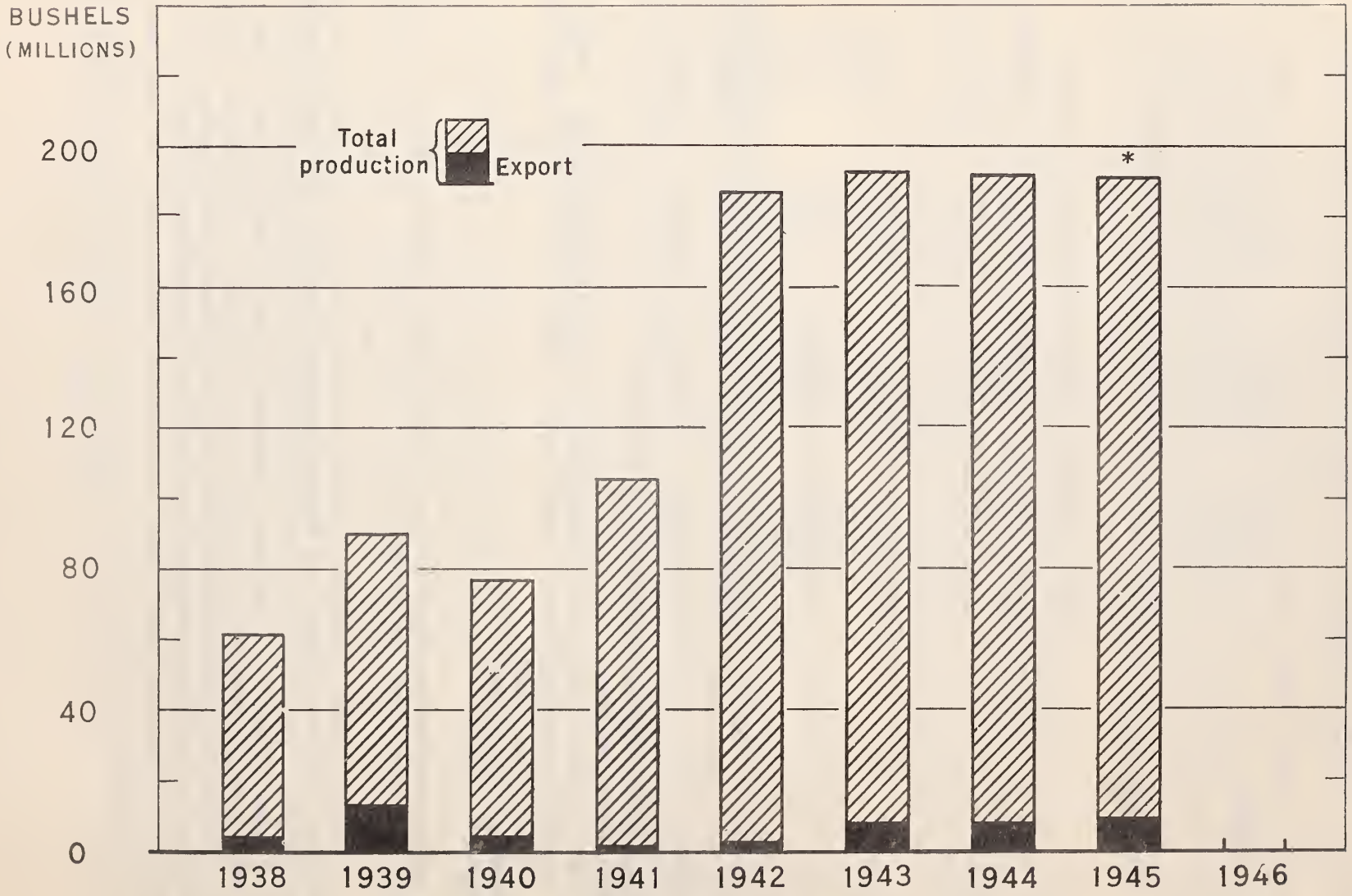
Country	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Europe	--	2.0	45.0	50.0
U.S.S.R.	42.0	132.0	2/ 68.0	100.0
United States	163.0	369.0	1,118.0	3/3,750.0
Asia				
China	4/5,500.0	5/6,513.0	5,525.0	6,000.0
Manchuria	4,424.0	4,863.0	4,074.0	5,100.0
Korea	542.0	553.0	522.0	525.0
Netherlands East Indies	106.0	139.0	236.0	375.0
Japan	384.0	346.0	325.0	400.0
Others	187.0	25.0	24.0	100.0
Total	11,143.0	12,439.0	10,706.0	12,500.0
World total	11,348.0	12,942.0	11,937.0	16,400.0

1/ Estimate by the writer for a year about 1955.
2/ One year only available.
3/ Based on 7 million acres and a production of 140 million bushels. (The highest production during the war period was in 1943 when the total production reached 193 million bushels.)
4/ Estimate by the writer.
5/ Average of 3 years.

Source: Based on data published by the International Institute of Agriculture, Rome.

In world trade, soybeans did not become important until shortly before the first World War when China and Manchuria were about the only areas exporting this oilseed. The high value of the soybean meal for livestock feed is one of the chief reasons for the rapid growth in international trade. The northern European countries early became heavy importers of soybeans. Shortly before the second World War Manchuria was by far the heaviest exporter of soybeans, and the only other export area of any consequence was Korea. In addition, the Netherlands East Indies has begun to have a small net export of soybeans (table 14).

PRODUCTION AND EXPORT OF SOYBEANS AND SOYBEAN OIL IN TERMS OF SOYBEANS, UNITED STATES, 1938-45



* PRELIMINARY (EXPORT FOR 1945 ESTIMATED)

U. S. DEPARTMENT OF AGRICULTURE NEG. 45705 BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 3

Table 14.- Average net export of soybean oil and soybeans in terms of oil equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	—	—	5.1	0	0
United States	0	0	0	.2	35.0
Asia					
China	139.4	371.2	60.5	.8	0
Manchuria			443.4	387.4	440.0
Korea	13.8	26.4	24.5	15.7	0
Netherlands East Indies	0	0	0	0	5.0
Others	3.0	.9	—	—	.0
Total	156.2	398.5	528.4	403.9	445.0
World total	156.2	398.5	533.5	404.1	480.0

1/ Estimate by the writer for a year about 1955.

Source: Based on data published by the International Institute of Agriculture, Rome.

It is possible that the export of soybeans from Manchuria and Korea may decline during the postwar years much below prewar levels, and China may completely disappear from the world export market. The anticipated industrial development in the Far East, together with improved internal economic conditions, should raise the standard of living which would probably result in considerably smaller exportable agricultural surpluses. The Soviet Union and perhaps China may also be competing with Japan and European countries for soybeans from Manchuria and Korea. If these developments materialize, they would result in a further decline in the quantities of soybeans and soybean products entering world markets from Manchuria and Korea, and might cause an increase in export from producing areas such as the United States and the Netherlands East Indies.

A considerably higher world level of production of soybeans than prevailed in prewar years is expected. This will result partly from increased wartime production in the United States and partly from improved production practices and higher yielding varieties of soybeans.

Exports of soybeans from Manchuria probably will not increase in proportion to the increase in production. A larger part of the soybeans produced are likely to be used in home consumption. There is a possibility, however, that relatively more soybeans may be exported to the Soviet Union and China. If this should be the case, the United States export of soybeans and soybean products to European countries might reach a level comparable with or perhaps above immediate prewar years.20/ The future of international trade in soybeans is very difficult to foresee as it is tied up with the economic development of the Far East.

Cottonseed and Cottonseed Oil

Cottonseed oil is one of the world's major food oils. On the basis of total world production of cottonseed the oil equivalent averaged about 2 million metric tons during the period 1934-38. About one-fourth of the cottonseed is used for seed, feed and fertilizer, leaving enough to produce about 1.5 million metric tons of oil.

Cottonseed is a byproduct in the production of cotton. The volume produced is therefore determined by the same factors that influence the output of cotton. The major producing countries include the United States, Brazil, Egypt, the Soviet Union, India, and China (table 15). Decreased production in the United States before the war has been offset by increases in other countries, particularly Brazil, the Soviet Union and China.

World trade in cottonseed and cottonseed oil is relatively small averaging only slightly more than 10 percent of the estimated oil equivalent. The United States, at one time an important exporter, has almost completely disappeared from the world export market. The principal exporting countries include Brazil, Egypt, British controlled areas in East Africa, and to a limited extent China and Manchuria which exported some cottonseed to Japan (table 16).

War materially reduced the total trade in cottonseed and cottonseed oil despite the expanded production in some of the South American countries, particularly Brazil and Argentina. In Egypt it is expected that production and trade after the war will return to the prewar volume.

20/ The highest prewar export from the United States was reached in 1939 when approximately 12 million bushels in terms of beans or almost 55,000 metric tons in terms of oil were exported.

Table 15.- Average production of cottonseed by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Europe	11.0	12.0	16.0	58.4	25.0
U.S.S.R.	418.0	390.8	759.0	1,424.2	2,000.0
North America					
United States	5,269.5	6,056.9	5,800.0	5,126.7	5,250.0
Mexico	101.8	105.3	83.0	121.0	150.0
Others	8.7	15.8	17.0	19.4	20.0
Total	5,380.0	6,178.0	5,900.0	5,267.1	5,420.0
South America					
Brazil	181.4	241.2	269.0	904.3	1,450.0
Argentina	1.5	51.7	84.6	145.8	250.0
Peru	60.8	82.6	96.3	137.6	150.0
Others	6.3	13.5	33.4	35.4	50.0
Total	250.0	389.0	483.3	1,223.1	1,900.0
Asia					
China	1,124.3	1,046.5	1,130.0	1,547.2	1,600.0
India	1,810.4	2,458.8	2,000.0	2,339.1	2,500.0
Iran	56.0	39.8	54.0	71.0	75.0
Turkey	51.6	45.3	49.2	122.8	125.0
Oceania	.5	6.0	5.7	4.7	5.0
Others	22.3	79.6	103.8	158.3	150.0
Total	3,065.1	3,676.0	3,342.7	4,243.1	4,455.0
Africa					
Belgian Congo	—	10.7	27.3	67.7	75.0
Egypt	610.1	683.6	673.0	770.8	750.0
Anglo-Egyptian Sudan	7.3	53.6	68.8	105.9	110.0
Uganda	10.3	72.0	93.5	136.7	150.0
Tanganyika	4.0	9.6	9.4	22.9	35.0
Others	18.3	51.5	41.0	75.8	80.0
Total	650.0	881.0	913.0	1,179.8	1,200.0
World total 2/	9,774.1	11,526.8	11,414.0	13,395.7	15,000.0

1/ Estimate by the writer for a year about 1955.
2/ Some countries with very small production not included.

Source: Based on data published by the International Institute of Agriculture, Rome.

Table 16.- Average net export of cottonseed oil and cottonseed in terms of oil-equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	0	5.2	7.2	7.0	0
United States	128.5	23.6	15.1	0	0
Mexico	--	3.2	--	--	--
South America					
Brazil	5.5	3.2	2.4	30.0	56.0
Argentina	--	1.0	--	--	20.0
Peru	2.5	6.0	2.7	4.6	6.0
Total	8.0	10.2	5.1	34.6	82.0
Asia					
China	(5.9	(7.6	(9.8	(22.0	12.0
Manchuria	(	(	(	(	7.0
Korea	--	1.4	1.2	3.6	2.0
India	34.8	22.6	4.5	.9	0
Total	40.7	31.6	15.5	26.5	21.0
Africa					
Egypt 2/	68.1	56.7	52.2	62.4	60.0
Anglo-Egyptian Sudan 3/	.8	5.6	9.3	12.8	15.0
British East Africa 4/	.8	5.1	8.8	13.4	15.0
Nigeria	.6	.4	.9	1.8	2.0
Others			.3	4.5	6.0
Total	70.3	67.8	71.5	94.9	98.0
World total	247.5	141.6	114.4	163.0	201.0

1/ Estimate by the writer for a year about 1955.
2/ Shipments to the Sudan, mostly consisting of seed for planting, not included.
3/ Includes export to Egypt.
4/ Kenya, Tanganyika, and Uganda.

Source: Based on data published by the International Institute of Agriculture, Rome.

World production of cottonseed is expected to increase moderately during the postwar period, perhaps 10 to 15 percent by 1955 over the prewar level. Only a small part of this increase, if any, will take place in the United States where the acreage planted with cotton dropped sharply during the war, mostly as a result of the shortage of labor and the relatively higher prices for other crops. 21/ Total production may nevertheless be restored to prewar levels of slightly over 13 million bales annually through higher yields per acre if a moderately high level of employment can be maintained. 22/ Much of the increase in cotton production will probably take place in deficit areas like the Soviet Union even though this area has tremendous forest resources for use in the production of rayon. Expansion is also likely to be considerable in countries with relatively primitive agriculture like China, Manchuria, and India, as well as in countries where the production costs are relatively low such as the British controlled areas in East Africa and perhaps Brazil and Argentina. There is a possibility, however, that the expansion in surplus-producing countries may be curtailed through international agreement. In that event there would probably be little or no increase in the international trade in cottonseed and cottonseed oil. Moreover, increased consumption in the producing countries may leave but small quantities for export.

A factor to be considered in estimating the future production of cotton is the development and increased use of synthetic textiles such as rayon and nylon. The production of these showed tremendous increases each recent year before the war, and with the great advances in technology made during the war the use of synthetic textiles must be expected to increase. 23/ It is therefore possible that cotton production in such countries as the United States may be severely affected by not being able to dispose of large quantities of short-staple cotton. Estimates used here are not based on the anticipation of any such development but it is a probability which cannot be ignored.

Olive Oil 24/

Olives have been produced for human use from ancient times. Production and consumption then as now was centered around the Mediterranean Sea. In modern times the production has spread to the western hemisphere.

21/ What Peace Can Mean to American Farmers. Misc. Pub. 562, USDA., 1945.
22/ Langsford, E. L. Changes in Cotton Production in War and Peace. Dec. 1944, USDA. (Processed.)
23/ Cooper, R. Maurice and Porter, Horace G. Synthetic Fibers in Relation to American Cotton. USDA., January 1945. (Processed.)
24/ This section is based in part upon information obtained through Mr. W. R. Schreiber, Office of Foreign Agricultural Relations, USDA.

Production of olives, like that of many other tree crops, is characterized by extreme variation from one year to the next in total quantity produced. A year of high production is frequently followed by one of very low production. The olive tree is about 10 years old before its production is of commercial importance. It is therefore a rather slow process to increase the output of olives and olive oil. Olive trees are extremely long-lived. In the Mediterranean area, the home of the olive tree, some trees have been found which were judged to be 200 to 300 years old yet were still bearing fruit.

World production of olive oil in the principal areas during the prewar period, 1934-38, averaged 869 thousand metric tons (table 17). Of this quantity, 87 percent was produced in Europe, 5.2 percent in the Near East, and 7.8 percent in North Africa. Nearly all the olive oil is produced in countries near to or bordering on the Mediterranean Sea. The most important of these are Spain, Italy, and Greece. Spain and Greece also produce considerable quantities of olives for table use. Small quantities of olives grown in North and South America are used mainly for table use. Only small quantities of olive oil are produced which have not been included in the above total.

Olive production in many countries has shown a moderate trend toward a larger volume as new lands have been made available and production practices have improved. This has been particularly evident in recent years in Tunisia, French Morocco, Palestine, and the Levant. The program for expansion during the next 10 to 15 years is especially ambitious in French Morocco where the production is expected to double by 1960.

World trade in edible olive oil is relatively important although the volume of net export is small and is apparently declining. The most important of the producing countries, such as Spain and Italy, sell sizable quantities of olive oil and import instead cheaper oils, such as peanut oil, for domestic consumption. There is no net export of olive oil from some of the producing countries, as Italy and France, because their export of high grade edible olive oil is offset by their import of lower grades of olive oil from countries that have less well developed crushing and refining industries (table 18).

World production of olive oil will probably increase moderately in the older producing countries through the use of more fertilizer and improved agricultural practices. New areas, suitable for olive production, located in Africa and South America (primarily Argentina) may be used to expand olive production if the price of olive oil is favorable. But total production of edible olive oil during the next decade is not likely to average much more than 900 thousand metric tons a year. 25/ International trade in olive oil may be affected by increased competition from cheaper oils which have become more generally usable because of technological advances. If this should result in a materially lower world price for olive oil it is likely that a greater part of the production will be consumed in the countries where it is produced. In this event the total export column may drop below the prewar average.

25/ The production of inedible olive oil, used largely in soap manufacturing, is reported to average from 5 to 10 percent of the annual production.

Table 17.- Average production of edible olive oil by leading producing countries for selected periods 1/

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 2/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Europe					
France	9.6	6.9	6.4	8.8	10.0
Greece 3/	89.7	80.2	103.8	101.4	100.0
Italy 3/	169.0	176.9	201.1	202.3	205.0
Portugal	22.7	40.0	53.1	46.7	55.0
Spain	219.7	350.0	356.4	392.9	390.0
Yugoslavia	—	3.9	4.7	4.0	5.0
Others 3/	10.4	7.4	--	--	3.0
Total	521.1	665.3	725.5	756.1	768.0
Africa					
Algeria	28.4	21.5	18.1	13.9	15.0
French Morocco	)	7.5	9.6	8.9	12.0
Tunisia	) 25.5	31.4	52.5	42.1	52.0
Libya	--	--	3.0	2.4	3.0
Total	53.9	60.4	83.2	67.3	82.0
Asia					
Turkey	4/)15.0	17.1	22.0	26.7	30.0
Syria and Lebanon	)	10.2	11.5	12.9	16.0
Palestine	--	--	2.5	6.0	9.0
Total	15.0	27.3	36.0	45.6	55.0
Total specified countries 5/	590.0	753.0	844.7	869.0	905.0

1/ Each period covers the crop years beginning with the first year listed. For example, 1909-13 covers average production for the crop year 1909-10 through 1913-14, etc.
2/ Estimate by the writer for a year about 1955.
3/ Data for 1909-13 not directly comparable with later years because of changes in territory after World War I.
4/ Estimated production.
5/ Does not include production in the Western Hemisphere and a few other countries with small production.

Source: Compiled from official statistics from the Office of Foreign Agricultural Relations, USDA (1929-40) and the International Institute of Agriculture, Rome.

Table 18.- Average net export of edible olive oil by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Europe					
Greece 2/	7.8	10.1	15.6	10.7	10.0
Italy 2/	34.1	7.8	0	0	0
Portugal	2.6	--	--	.8	1.0
Spain	39.2	73.8	70.7	52.4	60.0
Yugoslavia	0	0	.1	.2	0
Others	4.3	9.0	--	--	0
Total	88.0	100.7	86.4	64.1	71.0
Africa					
Algeria	4.6	12.8	12.6	9.4	10.0
French Morocco	5.4	1.8	--	2.5	4.0
Tunisia	8.2	15.5	34.2	33.4	36.0
Total	18.2	30.1	46.8	45.3	50.0
Asia					
Turkey 2/	9.4	5.3	11.0	4.6	5.0
Syria & Lebanon	--	1.4	2.2	6.5	8.0
Palestine	--	0	.2	.6	2.0
Total	9.4	6.7	13.4	11.7	15.0
World total 3/	115.6	137.5	146.6	121.1	136.0

1/ Estimate by the writer for a year about 1955.
2/ Data for 1909-13 are not directly comparable with those for later years.
3/ Includes all except a few countries with very minor exports.

Source: Based on data published by International Institute of Agriculture, Rome.

Sesame Seed and Sesame Oil

Sesame is an important annual oil crop grown chiefly in China and India. Production on a smaller scale has been slowly increasing in Africa. It is a plant suitable only for countries with warm climates, as it is extremely sensitive to cold. Production in Asia has shown but little variation over several decades. In the western hemisphere, production has shown considerable increase during the war years, particularly in Mexico.

World production of sesame seed fluctuates from approximately 1,500 thousand to about 1,800 thousand metric tons annually. The oil yield is about 45 percent and makes available some 650 to 800 thousand metric tons of oil, excluding the sesame seed needed for planting each year. China produced about 830 thousand metric tons or 57 percent of the World total during 1934-38, India was second, with 420 thousand metric tons or 28 percent (table 19). In comparison, Africa and Mexico each produced about 85 thousand metric tons in 1942.

Almost the entire production of sesame oil is used as a food oil in the countries of production. Small quantities have been imported to Europe for use in margarine and lard substitutes. In margarine its use in small quantities has been required by several European countries, because of a chemical reaction which permits margarine to be distinguished from butter by the use of a very simple analysis.

World trade in sesame oil and oilseed is small, involving about 10 percent of the production. The largest part of this comes from China, Manchuria, and India, although Africa has been supplying an increasingly larger proportion (table 20). The exports are taken mostly by Northern European countries but Japan was also a fairly large importer before the war.

Postwar prospects for increased production and trade in sesame seed and oil seem only limited. Production may expand to a small extent as a result of improved practices and perhaps increased use of commercial fertilizers, but the net quantities entering world markets will probably be only slightly, if any, above those of prewar years. Most of the sesame is produced in countries like China and India with huge populations and therefore with an enormous potential home market. Moreover, countries such as the Netherlands East Indies and parts of Africa have a large surplus production of cheaper oils in greater demand by importing countries.

Rapeseed and Mustard Seed and their Oils

World production of rapeseed (including both the summer and winter varieties) and mustard, although large in volume, is mostly of domestic interest in the countries in which produced, as only a very small part of the production enters world trade. 26/ This group is particularly important as a source of food oil in Asia, where it is among the leading vegetable-oil-producing crops, and in Europe where the production increased tremendously following the outbreak of each of the World Wars. The use of rapeseed oil for industrial purposes in addition to its use in food and soap is responsible for this increase.

26/ The summer variety of rapeseed is frequently referred to as Colza.

Table 19.- Average production of sesame seed by leading producing countries for selected periods 1/

Country	Average 1924-28	Average 1929-33	Average 1934-38	1955 2/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	9.9	16.1	3/ 8.7	10.0
Europe	5.3	8.8	10.8	5.0
Mexico	12.9	12.4	22.2	35.0
Asia				
China 4/	5/ 805.9	967.8	6/829.5	900.0
Burma	--	58.2	50.4	50.0
India	7/ 484.8	8/ 460.0	8/419.9	450.0
Japan	3.4	3.6	3.9	5.0
Netherlands East Indies	4.5	5.0	3.4	5.0
Turkey	20.2	29.7	27.2	28.0
Others	13.1	11.9	28.3	17.0
Total	1,331.9	1,536.2	1,362.6	1,455.0
Egypt	4.3	4.9	6.0	5.0
Belgian Congo	10.2	6.5	1.0	--
East Africa 9/	26.6	29.1	37.7	55.0
Nigeria and Cameroons	3.5	11.0	14.4	20.0
West French & Equatorial Africa	.9	3.3	6.1	10.0
Others	7.5	5.4	4.8	10.0
Total	53.0	60.2	70.0	100.0
World total 10/	1,413.0	1,633.7	1,474.3	1,605.0

1/ Consist in part of export data as no information for production is available in a few cases such as Nigeria, Belgian Congo and the Netherlands East Indies.
2/ Estimate by the writer for a year about 1955.
3/ 1934 only.
4/ Includes Manchuria.
5/ Estimate for China adjusted by the writer.
6/ 1934-36 only.
7/ Includes Burma.
8/ Includes French India.
9/ Kenya, Uganda, Tanganyika, and Anglo-Egyptian Sudan.
10/ Some countries with small production are not included because of lack of data and in others it has been possible to obtain only export data.

Source: Based on data published by International Institute of Agriculture, Rome.

Table 20.- Average net export of sesame seed and oil in terms of oil equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Asia					
China	62.5	22.1	47.9	33.1	30.5
Manchuria			6.1	7.0	10.0
India	55.9	10.2	5.7	4.5	5.3
Netherlands East Indies	.7	2.1	2.3	1.5	2.0
Turkey	6.4	1.4	1.4	.9	1.2
Others	.8	1.0	1.1	.9	1.0
Total	126.3	36.8	64.5	47.9	50.0
Africa					
East Africa 2/	3.5	6.4	8.4	13.4	15.0
Nigeria and Cameroons	.3	1.6	4.0	6.3	7.0
Others	2.0	2.9	2.7	--	4.0
Total	5.8	10.9	15.1	19.7	26.0
World total	132.1	47.7	79.6	67.6	76.0

1/ Estimate by the writer for a year about 1955.
2/ Anglo-Egyptian Sudan, Tanganyika, Kenya, and Uganda.

Source: Based on data published by International Institute of Agriculture, Rome.

Total world production of these oilseeds during prewar years averaged about 4 million metric tons, which is equivalent to a total oil production of 1 to 1.5 million tons. It is estimated that about 90 percent of this total was produced in Asia where China and India are the largest producers (table 21). During the war, production in the occupied part of Europe is estimated to have increased from about 200 thousand in prewar years to upward of 1 million metric tons in 1943-44. There was also an increase in the production in South America during the war, but this was much less than in Europe and apparently was for technical uses rather than for food purposes.

Table 21.- Average production of rapeseed and mustard seed in terms of oil equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	15.8	27.3	36.4	2/ 40.0	50
Europe					
Germany	6.6	10.8	4.6	30.2	10
France	14.4	7.9	7.5	4.5	2
Hungary	3.5	4.0	2.8	3.0	2
Romania	17.9	7.1	11.6	16.0	10
Poland	12.7	8.5	10.3	17.8	10
Czechoslovakia	20.6	1.2	.6	3.3	1
Others	3.9	14.2	9.8	14.5	15
Total	79.6	53.7	47.2	89.3	50
Asia					
China	3/ 945.0	3/ 910.1	773.0	833.4	850
India	432.4	347.3	359.9	340.3	360
Japan	42.7	24.7	28.6	42.0	40
Total	1,420.1	1,282.1	1,161.5	1,215.7	1,250
World total 4/	1,515.5	1,363.1	1,245.1	1,345.0	1,350

1/ Estimate by the writer for a year about 1955.
2/ 1934 only.
3/ Estimate made by the writer.
4/ Not including a few countries with very small production.

Source: Based on data published by International Institute of Agriculture, Rome.

Although the production of rapeseed and mustard seed has been important for a long time both in Europe and Asia, the trend has been downward since the early part of this century. The decline has come chiefly through the increased competition from tree oils produced in the tropical areas which began to arrive in larger quantities with the improvements in maritime transportation. Increases in European production since the middle of the 1930's have been due to increased tariff protection and other measures adopted in that area.

International trade in the oilseeds of these crops is relatively insignificant (table 22). During prewar years the only export of importance came from Asia, but even this had declined from a high of about 200 thousand metric tons in the middle 1920's to less than one-half of this quantity in the period before the war. This situation is not likely to change materially in the postwar years. In fact, the production of mustard and rapeseed seems destined to continue the downward trend followed before the middle 1930's and with the exception of limited quantities of oils for industrial use, the crop is likely to be consumed in the countries where it is produced.

Table 22.- Average net export of rapeseed and mustard seed in terms of oil equivalent for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	10.7	.2	.7	.1	0
Europe					
France	2.0	--	.1	.1	0
Hungary	.5	2.0	2.6	1.8	2
Romania	16.5	1.9	1.7	6.4	5
Poland	--	3.4	2.9	.5	2
Czechoslovakia	--	.4	.2	0	0
Others	2.4	3.6	2.0	2.2	1
Total	21.4	11.3	9.5	11.0	10
Asia					
China	9.2	16.8	14.1	6.4	15
India	87.7	44.6	20.4	7.2	25
Japan	3.0	7.4	8.7	16.4	10
Total	99.9	68.8	43.2	30.0	50
World total	132.0	80.3	53.4	41.1	60

1/ Estimate by the writer for a year about 1955.

Source: Based on data published by International Institute of Agriculture, Rome.

Sunflower Seed and Oil

The sunflower is grown mainly in the Soviet Union and parts of southern Europe. Since the beginning of the war there has been a phenomenal expansion in Argentina and Uruguay; both these countries have been able to find a ready market for the sunflower oil during the wartime shortage of oils. The sunflower oil can be used in place of peanut and cottonseed oil for food purposes; it is used mainly in margarine and vegetable shortening. In the Soviet Union a considerable part of the seed production is toasted and eaten, as peanuts are in this country.

Before the war about four-fifths of world production of sunflower seed was grown in the Soviet Union (USSR) (table 23). The total production calculated in oil averaged about 500 thousand metric tons annually, and nearly all of the production was consumed domestically either as seed or oil. It is the chief oil-producing crop in the Soviet Union. In comparison, the total production in other countries was negligible until the increases during the war brought the production up to a point where it probably is about equal to the production in the Soviet Union. Total world production in terms of oil was estimated at slightly more than 500 thousand tons in 1944, not including the Soviet Union. Argentina produced more than half of this quantity and several other countries in South America produced considerable quantities for home consumption.

Table 23.- Average production of sunflower seed, in terms of oil equivalent, by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38 1/	1955 2/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	165.0	468.3	526.0	487.5	550
Europe					
Romania		23.8	38.8	43.5	35
Bulgaria		5.5	17.5	30.0	25
Hungary		5.0	6.5	6.3	5
Czechoslovakia		--	—	1.2	0
Yugoslavia		--	--	1.0	3
Total		34.3	62.8	82.0	68
Argentina		.2	3.0	19.5	70
Uruguay		—	—	--	2
World total 3/	165.0	502.8	591.8	589.0	690

1/ 1934-36 only available.
2/ Estimate by the writer for a year about 1955.
3/ Production in countries with very small acreage not included.

Source: Based on data published by International Institute of Agriculture, Rome.

World trade in sunflower seed and oil was very small in prewar years. Bulgaria and Rumania exported small quantities most of which went to Germany and other European countries (table 24). During the war the export of sunflower seed oil, particularly from Argentina reached a very large volume when compared with prewar trade. Thus, the total export from Argentina in 1943-44 is estimated at over 50 thousand metric tons of oil equivalent or 200 thousand tons of sunflower seed (fig. 4).

The postwar outlook for sunflower oil is very uncertain. Production in the Soviet Union is likely to increase moderately, compared with prewar. A consumer demand for sunflower oil may have developed during the war but it is doubtful that such countries as Argentina will find it profitable to continue to grow as large areas in this crop when oils produced in the tropics again become available and other alternative enterprises are more favorable. Nevertheless, the production as well as the consumption of this oil in South American countries is likely to remain much higher than before the war.

Babassu Kernels and Oil

Babassu palms are found primarily in Brazil where the trees grow wild in huge numbers covering very extensive areas. Utilization of the nuts is made difficult by inadequate transportation facilities and by the lack of proper machinery to break the extremely hard shells. A machine recently invented to break the nuts is reported to have had moderate success. Difficulties in obtaining the machine and spare parts prevented its more general use during the war. Moreover, scarcity of laborers to gather the nuts has been a limiting factor which, together with the inadequate transportation, has held back any large-scale utilization of the babassu nuts.

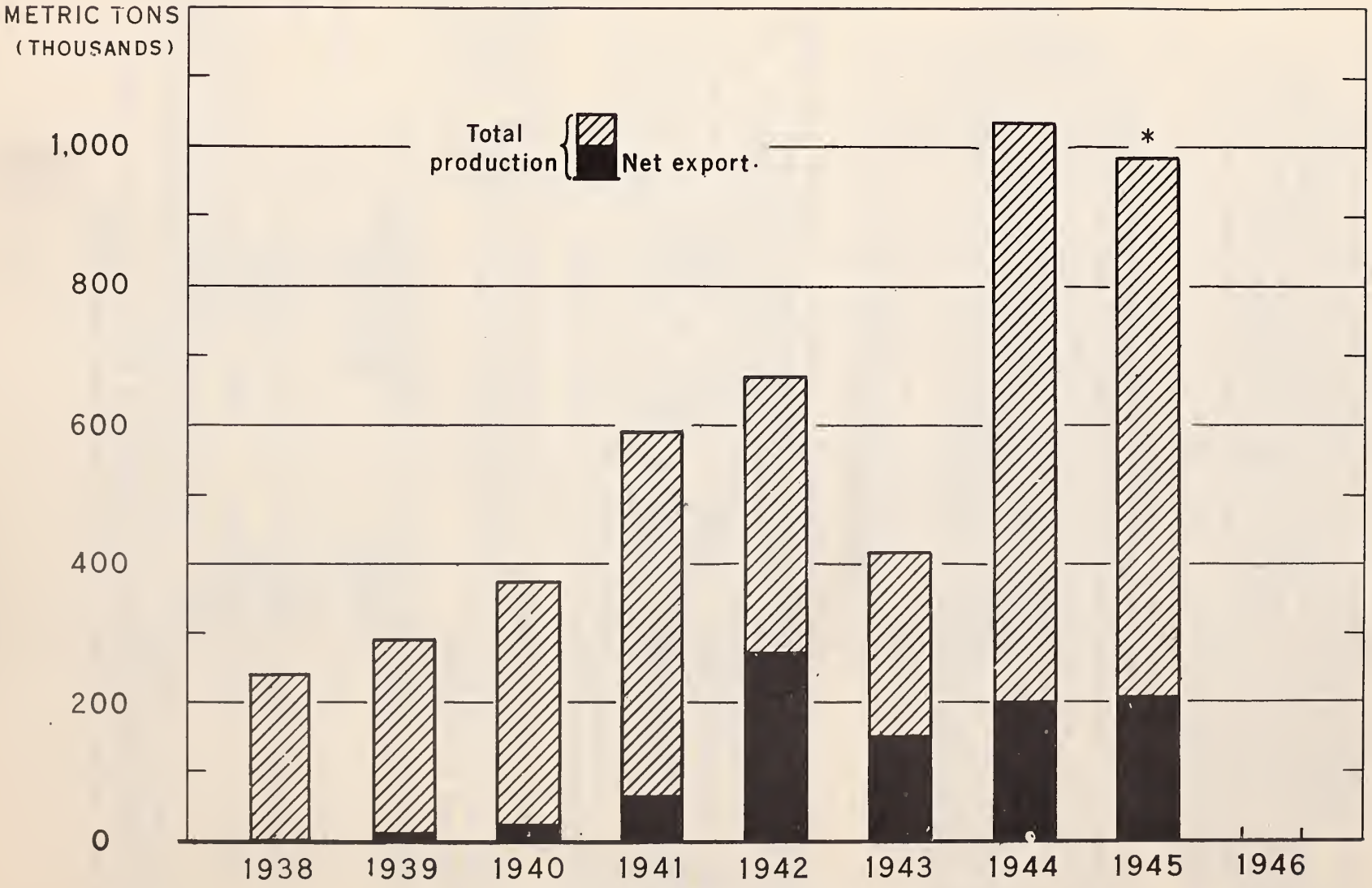
There are no adequate data indicating the size of the annual production in Brazil, but data are available showing the export of babassu kernels and oil. The average annual export in terms of oil by 5-year periods was as follows:

Period Average	Oil Equivalent Metric tons
1909-13	252
1924-28	12,222
1929-33	5,632
1934-38	11,871
1/ 1939-40	23,263
1955	2/ 30,000

1/ Two years.
2/ Estimate by the writer for a year about 1955.

Source: Office of Foreign Agricultural Relations, USDA.

PRODUCTION AND NET EXPORT OF SUNFLOWER SEED AND SUNFLOWER OIL IN TERMS OF SEED, ARGENTINA, 1938-45



* *PRELIMINARY, EXPORT ESTIMATED*

U. S. DEPARTMENT OF AGRICULTURE NEG. 45706 BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 4

Table 24.- Average net export of sunflower seed and oil in terms of oil equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	13.8	22.0	20.8	6.2	10
Europe					
Romania			11.4	12.4	5
Bulgaria			4.4	8.1	5
Hungary			.4	1.4	-
Total	2/	2/	16.2	21.9	10
Argentina			.2	1.2	25
World total 3/	13.8	22.0	37.2	29.3	45

1/ Estimate by the writer for a year about 1955.
2/ Separate data for sunflower seed and oil are not obtainable for earlier years because this oil seed was included under "other vegetable oils."
3/ A few countries with very small export not included.

Source: Based on data published by International Institute of Agriculture, Rome.

The United Kingdom and Germany were early importers of babassu kernels, but later these kernels were exported to the Netherlands, Belgium, and France. United States has been taking the largest proportion of the Brazilian export in recent years. Babassu oil is similar to coconut oil and palm-kernel oil and is used in the manufacture of soap and for food purposes.

The postwar outlook for increased production and trade in babassu kernels is uncertain despite the huge potentialities. Even if the use of machinery to crack the nuts becomes general, the relative inaccessibility of the production areas and the large amount of labor involved in gathering the nuts operate against the expansion of this industry. Furthermore, the industrialization apparently taking place in Brazil will provide other and more desirable opportunities for the Brazilian workers. However, with nut-cracking machinery it may be possible for the natives in the areas where the nuts are grown to gather considerably more, and the total harvest of babassu kernels may therefore increase considerably even with the same or a smaller labor force. Under these conditions and with improved transportation facilities, the total annual export may easily reach 30 thousand metric tons in terms of babassu oil. This would be

equal to the levels reached during the war but would be about three times as large as the prewar average. It is uncertain, however, how much the living standards will improve and the size of population in Brazil will increase during the next decade. If the country is industrialized fairly rapidly and immigration is made easier, particularly of industrial workers from Europe, there may continue to be a considerable export surplus of babassu kernels.

Flaxseed and Linseed Oil

Linseed oil is used for both food and industrial purposes. During normal times the industrial uses are most important because of the recognized drying qualities which make linseed oil particularly useful in the manufacture of paints, varnishes, linoleum, and many other articles. Linseed oil in its cold-pressed form is used for food purposes in India and the Soviet Union.

The principal producers of flaxseed are Argentina, the Soviet Union, and India. The United States is fourth in importance (table 25). Production in the United States and Canada was especially low during the middle 1930's as a result of persistent droughts. World production of flaxseed has been almost constant during the years since World War I but it is likely that there will be an upward trend during the next decade. The demand for linseed oil during the reconstruction period is likely to be very high, although the competition of other drying oils, and of new synthetic and chemical products including plastics, probably will be keen.

The importance of linseed oil in the manufacture of paints and varnishes, linoleum and oilcloth, and printing ink in the United States during 1935-39, in percentages of all oils used for these purposes, is indicated below:

Commodity	Linseed oil used
	Percent
Paints and varnishes	68
Linoleum and oilcloth	60
Printing ink	77

Linseed oil is usually the cheapest of the drying oils available for the manufacture of these commodities. Other oils, such as perilla and tung, are of higher quality and are more expensive, besides being available only in limited quantities. Perilla oil mixed with soybean oil is used as a substitute for linseed oil when perilla oil can be obtained. During the war dehydrated castor oil became an important substitute for the more scarce drying oils and it may be more commonly used after the war than before, if the cost of dehydration can be brought down.

Table 25.- Average production of flaxseed by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	486.7	563.0	762.6	737.3	800.0
Europe	192.0	193.1	167.0	224.2	150.0
United States	471.0	591.2	344.3	206.7	2/ 620.0
Canada	305.8	155.9	66.8	33.7	65.0
Mexico & Central America	32.2	1.9	1.9	2.4	--
South America					
Argentina	790.5	1,839.2	1,737.5	1,692.5	1,900.0
Uruguay	24.2	48.4	88.8	89.3	98.0
Others	.4	1.3	.7	--	2.0
Total	815.1	1,888.9	1,827.0	1,781.8	2,000.0
Asia					
India	504.8	402.2	386.3	419.6	500.0
Japan	--	--	3.0	4.7	5.0
Turkey	--	--	5.3	6.9	8.0
Others 3/	3.6	10.0	3.0	.7	22.0
Total	508.4	412.2	397.6	431.9	535.0
Africa	9.0	15.2	14.7	11.0	15.0
World total 4/	2,820.2	3,821.4	3,581.9	3,429.0	4,185.0

1/ Estimate by the writer for a year about 1955.
2/ Production of flaxseed in the United States reached a high of 1,450,000 metric tons or 52 million bushels in 1943.
3/ Includes small quantities produced in Oceania, Australia, and New Zealand.
4/ A few countries with very small production are not included.

Source: Based on data published by International Institute of Agriculture, Rome.

International trade in flaxseed and linseed oil is relatively heavy. More than half of the world production normally is exported, mostly as flaxseed rather than as oil. The principal exporter is Argentina which ships about 90 percent of its production and provides at least 80 percent of the world's total export. India and Uruguay are next in importance from the standpoint of total export. In proportion to production Uruguay exports as much as Argentina, while India exports only a little more than 50 percent of its production (table 26). Neither the United States nor the Soviet Union has any surplus available for export despite their relatively large production of flaxseed. In fact, the United States is one of the world's largest importers. Canada was once an important exporter of flaxseed but has practically disappeared from the world export market and is not expected to loom large during the postwar years.

Table 26.- Average net export of flaxseed in terms of oil equivalent by leading producing countries for selected periods

Country	Average 1909-13	Average 1924-28	Average 1929-33	Average 1934-38	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
U.S.S.R.	46.4	8.8	.9	.1	30.0
Canada	63.2	28.2	2.0	--	--
Argentina	233.9	532.5	549.9	524.1	600.0
Uruguay	6.8	16.0	27.8	24.8	30.0
India	127.2	86.4	72.4	80.5	110.0
Others 2/	90.3	28.2	5.8	14.3	10.0
World total	567.8	700.1	658.8	643.8	780.0

1/ Estimate by the writer for a year about 1955.
2/ Includes China and a number of other countries with small exports.

Source: Based on data published by International Institute of Agriculture, Rome.

Lack of shipping forced Argentina to crush a large part of the flaxseed produced there during the war and to use linseed oil as fuel because of the extreme shortages of coal, fuel oil, and gasoline.

A large secondary trade existed in flaxseed oil before the war. The Netherlands, Germany, Belgium, and the United Kingdom imported and crushed large quantities of linseed. The oil was then refined and a considerable part was re-exported, whereas most of the linseed meal was used to feed livestock. This trade will probably be re-established now the war is over, as the producers in Argentina and Uruguay probably will find this more profitable than crushing the flaxseed at home. The Argentine farmers have but little need for the large quantities of linseed meal which would be available, whereas the European livestock producers can use almost all they can obtain.

The acreage of flaxseed in Argentina has been relatively stationary over a period of years although the total acreage in crops has been increasing as a result of the increased acreage devoted to oats, barley, and corn. Argentina appears to hold a comparative advantage over the United States in the production of flaxseed, based upon higher yields, cheaper transportation, and lower production costs. However, it is not at all certain that the production of flaxseed will be greatly increased there unless the price becomes more attractive as compared with other crops, or unless there is a subdivision of the large land holdings. Such a dividing would apparently bring a marked expansion in the acreage of cultivated crops and a decrease in pasture lands.

The immediate postwar outlook for flaxseed and linseed oil appears to be bright. During this reconstruction period the demand for linseed oil is likely to be very high. Moreover, the building boom, which many expect in the United States and other countries that were not directly touched by the destruction of war, but where materials for building construction also have been scarce, should further increase this demand for linseed oil. On this basis, and considering the decrease in world production as a result of the drought years in North America during the 1930's, it appears reasonable to expect a level of world production, by 1955, some 15 to 20 percent higher than the average production during the 15 years from 1924 to 1938. World production of flaxseed would then be at least 4 million metric tons annually, of which a somewhat larger proportion than during prewar years would enter foreign trade. The greater part of the increased production would be in the United States but there would also be a substantial increase in Argentina and Uruguay. Under favorable circumstances the increase in Argentina and Uruguay might easily be much greater as the productive resources are there, and need only the stimulant provided by a good foreign buying power. The market provided by the United States and other countries is therefore likely to be the determining factor in this expansion.

Tung, Perilla, and Castor Oils

Tung and perilla are industrial oils used mainly in the drying industries. These oils are relatively scarce and are therefore rather expensive. The production of tung oil is centered in China and of perilla oil in Manchuria.

The total production of tung oil is very small as compared with the major oil crops. In China, the total production before the war was estimated to average about 140 thousand metric tons annually of which a little more than one-half was exported.

Most of the tung oil in China is apparently produced on marginal lands and provides a small supplementary income for the farmers in these areas. Small quantities of tung oil are produced in the United States, Argentina, and Brazil. Several other countries produce tung oil but their production is low and mostly experimental. Any expansion in production is relatively slow as it takes 5 years before the trees produce enough nuts to be of commercial importance.

World trade in tung oil is almost completely dominated by China as exporter and the United States as importer. The export of tung oil from China has been a government monopoly since 1938 when this export was set aside as a sort of collateral for an American loan of 25 million dollars.

The total exports from China and imports by the United States are estimated as follows:

Table 27.- Tung Oil: Average exports from China and imports by the United States

Period	Exports from China	Imports by United States
	Metric tons	Metric tons
Average		
1924-28	55,000	41,000
1929-33	62,000	45,000
1934-38	78,000	58,000
1939	54,000	36,000
1955 1/	100,000	65,000

1/ Estimate by the writer for a year about 1955.

Source: International Institute of Agriculture, Rome.

According to these data the trend in China has been toward larger exports. Presumably production has been increasing. It is probable that this development may continue as the yields of tung oil on properly cultivated land appear to place China at a comparative advantage in production. Thus it is reported that the yields of tung oil on a limited number of plantations established in the province of Chekiang average about 2 metric tons per hectare or nearly 1,800 pounds per acre. This yield is not representative of China as a whole, but may indicate the possibilities. In comparison, the yields reported in the United States are small. 27/

27/ International Institute of Agriculture. Fats and Oils: Production and International Trade, pp. 240-244. Rome 1939. (In one survey made in 1935 covering trees 7 to 10 years old the average yield of oil was given as only about 80 pounds per acre. Other estimates have placed the yield in the United States as high as 300 pounds of oil per acre.)

Perilla oil, the other drying oil imported in the United States from the Far East, reached noteworthy proportions only after the United States placed an import duty on flaxseed and soybeans and their oils, but did not include perilla oil as dutiable until some time later.

Production of perilla seed increased from year to year during the 1930's and is estimated to have reached about 150 thousand metric tons annually. This was related to the discovery that a mixture of perilla oil and soybean oil compared favorably with linseed oil in industrial uses. Increased production in Manchuria is reported to have resulted to some extent from low prices and yields of soybeans.

The approximate exports of perilla seed and oil in terms of oil equivalent is shown in table 28 together with the imports to the United States for the period 1924-28 and annually from 1929 to 1939.

Table 28.- Perilla Oil: Exports from Manchuria and imports by the United States

Period	Exports from Manchuria	Imports by United States
	Metric tons	Metric tons
1924-28 average	4,300	2,160
1929	4,300	2,500
1930	7,500	4,000
1931	14,500	6,000
1932	11,100	7,500
1933	15,900	10,500
1934	18,900	11,800
1935	43,700	33,300
1936	75,700	1/ 54,100
1937	52,000	19,800
1938	68,000	14,400
1939		24,400

1/ United States placed an import tax of 4½ cents per pound on perilla oil beginning January 1, 1937.

Source: International Institute of Agriculture: Oils and Fats: Production and International Trade, Rome 1939, also U. S. Tariff Commission: Fats and Oils, 1941, p. 26.

Castor Oil is a vegetable oil which has increased in importance during the last 10 to 15 years. Earlier, it was best known for its medicinal properties but it is now much more important as an industrial oil. It is used extensively as an industrial lubricant, as an hydraulic brake fluid, and as a drying oil in its dehydrated form.

Production of castor beans has more than doubled since 1925-29 when it averaged about 250 thousand metric tons. India was then the leading producer but Brazil has since emerged as the world's largest producer and exporter of castor beans and castor oil. Production in Brazil rose from less than 20 thousand metric tons annually in 1925-29 to more than 200 thousand in 1940. Castor beans have an oil yield of about 45 percent, and world production in terms of oil reached about 230 thousand metric tons in 1940.

The world production of castor beans originates almost entirely in Brazil, the Soviet Union, and India. These countries accounted for 90 percent of the total in 1940 (table 29.) India, once the largest producer, is now third. In world trade Brazil accounts for more than one-half of the total export, and India is second. The Soviet Union is not an exporter. World total export in terms of oil equivalent was about 90 thousand metric tons before the war and reached about 125 thousand tons in 1941.

Table 29.- World production of castor beans by leading producing countries, for selected periods

Country	Average 1925-29	Average 1930-34	Average 1935-39	1940	1955 1/
	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons	1,000 metric tons
Brazil	17.3	90.3	143.6	202.9	180.0
India	131.7	137.4	115.6	98.6	120.0
China-Manchuria	9.0	18.6	25.8	20.0	30.0
U.S.S.R.	27.0	38.2	106.8	158.8	150.0
Others (Asia)	65.0	65.5	68.2	29.7	60.0
Total	250.0	350.0	460.0	510.0	540.0

1/ Estimates for a year about 1955 made by the writer.

Source: Office of Foreign Agricultural Relations, USDA.

From present indications and the prewar trend it appears that during the postwar period the production of castor beans will continue at a high level, with international trade in terms of oil equivalent remaining above the 100 thousand metric tons mark. The demand for dehydrated castor oil will probably continue until adequate supplies of other more desirable drying oils are available.

In the period ahead, the United States undoubtedly will continue to be the world's leading importer of tung oil and castor beans. The future with respect to import of perilla oil is more difficult to anticipate. The import of this oil has been significant, particularly in years when the import duties gave it an advantage over other drying oils.

Technological developments which have produced dehydrated castor oil and made it possible to fractionate soybean oil may result in a much lesser need for the recognized drying oils of prewar days. But the total demand for drying oils may be expected to show a strong upward trend because of the need for these oils in the construction industries.

SUMMARY AND CONCLUSIONS

The world trend in production of the major vegetable oils has been strongly upward since before the first World War. This movement has been particularly pronounced for palm, palm-kernel, and coconut oils which are produced in the tropics. The expansion in production has been accompanied by an increasing demand for vegetable oils in the western industrialized countries. Rapidly-growing populations and a rising level of living made it uneconomical for domestic sources of fats and oils in these countries to provide all of the needed supplies which then were imported.

Looking ahead, total world production of the major oil crops may reach a level about one-third higher than that of the 5-year period 1934-38 by the end of the first decade following World War II, if conversion to settled peacetime conditions is successful and if a continuing condition of world prosperity prevails.

The world net export of major oil crops may also expand considerably by 1955, perhaps about 20 percent. The higher rate of expansion is estimated for world production because of large increases in oil production in several important countries, which will be on a net import basis or will have a very small increase in net exports. India, China, and the United States are leading examples.

The principal areas of potential export expansion are the same that were vigorously increasing output before the war - namely, Southeast Asia and West and Central Africa. The Philippines, the Netherlands East Indies, Malaya, and French, British, and Belgian Central and West Africa are the areas of greatest potential increase. These tropical areas appear to have a great comparative advantage over the temperate zones in specialized vegetable-oil production. If it were not for the joint and byproduct relationships with food, feed, and fiber, much of the oil-crop production of the temperate zones might quickly contract.

Current and prospective changes in production, transportation, and utilization are likely to bring many adjustments which as yet cannot be fully comprehended. Moreover, if we have a period of relatively full employment with greater freedom of international trade it will permit many maladjustments in agricultural production, which originated in the interwar period, to work themselves out in accordance with the principle of comparative advantage. If such adjustments materialize, chronic surpluses of fats and oils are not likely to become serious, as the high-cost producers will have favorable opportunities to shift to other commodities which they can produce more profitably at prevailing prices.

A continued expansion in world production of vegetable oils means increased international trade because a large part of the increase is anticipated in surplus-producing areas. As most of the expansion in exports will consist of tropical oils it means that these areas have an additional basis for exchange with the temperate zones. Africa and the Far East will then be in position to buy more factory goods from the United States and Europe. This in turn will mean larger domestic markets for farmers in the United States because of greater employment opportunities for industrial workers. The improvement in the domestic market for livestock products as a result of greater purchasing power may well mean more to farmers here than any moderate reduction in the oil crops produced domestically, which may result from the international competition in fats and oils.

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